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Lestoff, L'Estrange.

LESTOFF, or LEOSTOFF, a town of Suffolk in England, seated on the sea-shore, 117 miles north-west of London. It is concerned in the fisheries of the North-sea, cod, herrings, mackerels, and sprats; has a church, and a dissenting meeting-house; and for its security, six eighteen-pounders, which they can move as occasion requires; but it has no battery. The town consists of 500 houses; but the streets, though tolerably paved, are narrow. It has a market on Wednesdays, and two fairs in the year for petty chapmen. The coast is there very dangerous for strangers.

L'ESTRANGE (Sir Roger), a noted writer in the 17th century, was descended from an ancient family, seated at Hunstanton-hall in the county of Norfolk, where he was born in 1616, being the youngest son of Sir Hammond L'Estrange baronet, a zealous royalist. Having in 1644 obtained a commission from King Charles I. for reducing Lynn in Norfolk, then in possession of the parliament, his design was discovered, and his person seized. He was tried by a court martial at Guildhall in London, and condemned to die as a spy; but was reprieved, and continued in Newgate for some time. He afterward went beyond sea; and in August 1653 returned to England, where he applied himself to the protector Oliver Cromwell, and having once played before him on the bass-viol, he was by some nicknamed *Oliver's fiddler*. Being a man of parts, master of an easy humorous style, but withal in narrow circumstances, he set up a newspaper, under the title of *The Public Intelligencer*, in 1663; but which he laid down, upon the publication of the first London gazette in 1665, having been allowed, however, a consideration by government. Some time after the Popish plot, when the Tories began to gain the ascendant over the Whigs, he, in a paper called the *Observator*, became a zealous champion for the former. He was afterwards knighted, and served in the parliament called by King James II. in 1685. But things taking a different turn in that prince's reign, in point of liberty of conscience, from what most people expected, our author's *Observators* were diffused as not at all suiting the times. However, he continued licenser of the press till King William's accession, in whose reign he met with some trouble as a disaffected person. However, he went to his grave in peace, after he had in a manner survived his intellectuals. He published a great many political tracts, and translated several works from the Greek, Latin, and Spanish; *viz.* Josephus's works, Cicero's Offices, Seneca's Morals, Erasmus's Colloquies, Æsop's Fables, and Bonas's Guide to Eternity. The character of his style has been variously represented; his language being observed by some to be easy and humorous, while Mr Gordon says, "that his productions are not fit to be read by any who have taste or good-breeding. They are full of phrases picked up in the streets, and nothing can be more low or nauseous."

Lestweithel ‖ Lethargy.

LESTWEITHEL, a town of Cornwal in England, about 229 miles distant from London. It is a well-built town, where are kept the common gaol, the weights and measures for the whole stannary, and the county courts. It stands on the river Foy, which brought up vessels from Fowey, before it was choaked up with sand coming from the tin-mines, and therefore its once flourishing trade is decayed; but it holds the bushelage of coals, salt, malt, and corn, in the town of Fowey, as it does the anchorage in its harbour. It was made a corporation by Richard earl of Cornwal when he was king of the Romans, and has had other charters since. It consists of seven capital burgesses (whereof one is a mayor), and 17 assistants or common council. It is part of the duchy of Cornwal, to which it pays L. 11 : 19 : 10 a year for its liberties. Its chief trade is the woollen manufactory. Its church has a spire, the only one except that of Helston in the county. Its market is Friday, and its fairs are three. It first returned members to parliament in the 33d of Edward I. They are chosen by their burgesses and assistants. It was anciently the shire-town, and the knights of the shire are still chosen here.

LETCHLADE, a town of Gloucestershire, 90 miles from London, on the borders of Oxfordshire and Berks, and the great road to Gloucester; had anciently a nunnery, and a priory of black canons. In this parish is Clay-hill. The market is on Tuesday; and it has two fairs. It is supposed to have been a Roman town: for a plain Roman road runs from hence to Cirencester; and by digging in a meadow near it some years ago, an old building was discovered, supposed to be a Roman bath, which was 50 feet long, 40 broad, and 4 high, supported with 100 brick pillars, curiously inlaid with stones of divers colours of tesseraic work. The Leech, the Coln, the Churn, and Isis, which all rise in the Cotswould-hill, join here in one full stream, and become one river, called the *Thames*, which begins here to be navigable, and barges take in butter, cheese, and other goods, at its quay for London.

LETHARGY, in medicine (from λεθη *oblivion*, and αργια *numbness*, *laziness*), a disease consisting of a profound drowsiness or sleepiness, from which the patient can scarce be awaked; or, if awaked, he remains stupid, without sense or memory, and presently sinks again into his former sleep. See MEDICINE-*Index*.

LETHARGY, in farriery. See there, § 9.

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Letter.

LETHE, in the ancient mythology, one of the rivers of hell, ſignifying oblivion or forgetfulneſs; its waters having, according to poetic fiction, the peculiar quality of making thoſe who drank them forget every thing that was paſt.

LETI (Gregorio), an eminent Italian writer, was deſcended of a family which once made a conſiderable figure at Bologna: Jerom, his father, was page to prince Charles de Medicis; ſerved ſome time in the troops of the grand duke as captain of foot; and ſettling at Milan, married there in 1628. He was afterward governor of Almantea in Calabria, and died at Salerno in 1639. Our author was born at Milan in 1630, ſtudied under the Jeſuits at Coſenza, and was afterward ſent by an uncle to Rome, who would have him enter into the church; but he being averſe to it, went into Geneva, where he ſtudied the government and the religion there. Thence he went to Lauſanne; and contracting an acquaintance with John Anthony Guerin, an eminent phyſician, lodged at his houſe, made profeſſion of the Calviniſt religion, and married his daughter. He ſettled at Geneva; where he ſpent almoſt twenty years, carrying on a correſpondence with learned men, eſpecially thoſe of Italy. Some conteſts obliged him to leave that city in 1679; upon which he went to France, and then into England, where he was received with great civility by Charles II. who, after his firſt audience, made him a preſent of a thouſand crowns, with a promiſe of the place of hiſtoriographer. He wrote there the Hiſtory of England; but that work not pleaſing the court on account of his too great liberty in writing, he was ordered to leave the kingdom. He went to Amſterdam in 1682, and was honoured with the place of hiſtoriographer to that city. He died ſuddenly in 1701. He was a man of indefatigable application, as the multiplicity of his works ſhow. The principal of theſe are, 1. The univerſal monarchy of Louis XIV. 2. The life of Pope Sixtus V. 3. The life of Philip II. king of Spain. 4. The life of the emperor Charles V. 5. The life of Elizabeth, queen of England. 6. The hiſtory of Oliver Cromwell. 7. The hiſtory of Great Britain, 5 vols 12mo. 8. The hiſtory of Geneva, &c..

LETRIM, a county of Ireland, in the province of Connaught, 44 miles in length and 17 in breadth; bounded on the eaſt and north-eaſt by Cavan and Fermanagh, by Sligo and Roſcommon on the weſt and ſouth-weſt, and by Longford on the eaſt and ſouth-eaſt. It is a hilly country, with rank graſs, which feeds a great number of cattle. The chief town is Letrim, ſeated not far from the river Shannon. It contains 4000 houſes, 21 pariſhes, 5 baronies, 2 boroughs, and ſends 6 members to parliament.

LETTER, a character uſed to expreſs one of the ſimple ſounds of the voice; and as the different ſimple ſounds are expreſſed by different letters, theſe, by being differently-compounded, become the viſible ſigns or characters of all the modulations and mixtures of ſounds uſed to expreſs our ideas in a regular language; (See LANGUAGE). Thus, as by the help of ſpeech we render our ideas audible; by the aſſiſtance of letters we render them viſible, and by their help we can wrap up our thoughts, and ſend them to the moſt diſtant parts of the earth, and read the tranſactions of different ages. As to the firſt letters, what they were, who firſt invented them, and among what people they were firſt in uſe, there is ſtill room to doubt: Philo attributes this great and noble invention to Abraham; Joſephus, St Irenæus, and others, to Enoch; Bibliander, to Adam; Euſebius, Clemens Alexandrinus, Cornelius Agrippa, and others, to Moſes; Pomponius Mela, Herodian, Rufus Feſtus, Pliny, Lucan, &c. to the Phœnicians; St Cyprian, to Saturn; Tacitus, to the Egyptians; ſome, to the Ehtiopians; and others, to the Chineſe: but, with reſpect to theſe laſt, they can never be intitled to this honour, ſince all their characters are the ſigns of words, formed without the uſe of letters; which renders it impoſſible to read and write their language without a vaſt expence of time and trouble; and abſolutely impoſſible to print it by the help of types, or any other manner but by engraving, or cutting in wood. See PRINTING. Letter.

There have been alſo various conjectures about the different kinds of letters uſed in different languages: thus, according to Crinitus, Moſes invented the Hebrew letters; Abraham, the Syriac and Chaldee; the Phœnicians, thoſe of Attica, brought into Greece by Cadmus, and from thence into Italy by the Pelaſgians; Nicoſtrata, the Roman; Iſis, the Egyptian; and Vulfilas, thoſe of the Goths.

It is probable, that the Egyptian hieroglyphics were the firſt manner of writing: but whether Cadmus and the Phœnicians learned the uſe of letters from the Egyptians, or from their neighbours of Judea or Samaria, is a queſtion; for ſince ſome of the books of the Old Teſtament were then written, they are more likely to have given them the hint, than the hieroglyphics of Egypt. But whereſoever the Phœnicians learned this art, it is generally agreed, that Cadmus the ſon of Agenor firſt brought letters into Greece; whence, in following ages, they ſpread over the reſt of Europe. See ALPHABET and WRITING.

Letters make the firſt part or elements of grammar; an aſſemblage of theſe compoſe ſyllables and words, and theſe compoſe ſentences. The alphabet of every language conſiſts of a number of letters, which ought each to have a different ſound, figure, and uſe. As the difference of articulate ſounds was intended to expreſs the different ideas of the mind, ſo one letter was originally intended to ſignify only one ſound, and not, as at preſent, to expreſs ſometimes one ſound and ſometimes another; which practice has brought a great deal of confuſion into the languages, and rendered the learning of the modern tongues much more difficult than it would otherwiſe have been. This conſideration, together with the deficiency of all the known alphabets, from their wanting ſome letters to expreſs certain ſounds, has occaſioned ſeveral attempts towards an univerſal alphabet, to contain an enumeration of all ſuch ſingle ſounds or letters as are uſed in any language. See ALPHABET.

Grammarians diſtinguiſh letters into vowels, conſonants, mutes, liquids, diphthongs, and characteriſtics. They are likewiſe divided into capital and ſmall letters. They are alſo denominated from the ſhape and turn of the letters; and in writing are diſtinguiſhed into different hands, as round-text, German-text, round-hand, Italian, &c. and in printing, into Roman, Italic, and black letter.

The term LETTER, or *Type*, among printers, not only

Letter. ly includes the CAPITALS, SMALL CAPITALS, and ſmall letters, but all the points, figures, and other marks caſt and uſed in printing; and alſo the large ornamental letters, cut in wood or metal, which take place of the illumined letters uſed in manuſcripts. The letters uſed in printing are caſt at the ends of ſmall pieces of metal, about three quarters of an inch in length; and the letter being not indented, but raiſed, eaſily gives the impreſſion, when, after being blacked with a glutinous ink, paper is cloſely preſſed upon it. See the articles PRINTING and TYPE. A fount of letters includes ſmall letters, capitals, ſmall capitals, points, figures, ſpaces, &c.; but beſides, they have different kinds of two-line letters, only uſed for titles, and the beginning of books, chapters, &c. See FOUNT.

LETTER is alſo a writing addreſſed and ſent to a perſon. See EPISTLE.

The art of epiſtolary writing, as the late tranſlator of Pliny's Letters has obſerved, was eſteemed by the Romans in the number of liberal and polite accompliſhments; and we find Cicero mentioning with great pleaſure, in ſome of his letters to Atticus, the elegant ſpecimen he had received from his ſon of his genius in this way. It ſeems indeed to have formed part of their education; and, in the opinion of Mr Locke, it well deſerves to have a ſhare in ours. "The writing of letters (as that judicious author obſerves) enters ſo much into all the occaſions of life, that no gentleman can avoid ſhewing himſelf in compoſitions of this kind. Occurrences will daily force him to make this uſe of his pen, which lays open his breeding, his ſenſe, and his abilities, to a ſeverer examination than any oral diſcourſe." It is to be wondered we have ſo few writers in our own language who deſerve to be pointed out as models upon ſuch an occaſion. After having named Sir William Temple, it would perhaps be difficult to add a ſecond. The elegant writer of Cowley's life mentions him as excelling in this uncommon talent; but as that author declares himſelf of opinion, "That letters which paſs between familiar friends, if they are written as they ſhould be, can ſcarce ever be fit to ſee the light," the world is deprived of what no doubt would have been well worth its inſpection. A late diſtinguiſhed genius treats the very attempt as ridiculous, and profeſſes himſelf "a mortal enemy to what they call *a fine letter*." His averſion however was not ſo ſtrong, but he knew to conquer it when he thought proper; and the letter which cloſes his correſpondence with biſhop Atterbury is, perhaps, the moſt genteel and manly addreſs that ever was penned to a friend in diſgrace. The truth is, a fine letter does not conſiſt in ſaying fine things, but in expreſſing ordinary ones in an uncommon manner. It is the *proprie communia dicere*, the art of giving grace and elegance to familiar occurrences, that conſtitutes the merit of this kind of writing. Mr Gay's letter, concerning the two lovers who were ſtruck dead with the ſame flaſh of lightning, is a maſter-piece of the ſort; and the ſpecimen he has there given of his talents for this ſpecies of compoſition makes it much to be regretted we have not more from the ſame hand.

Ward's Oratory. *Of the Style of Epiſtolary Compoſition.* Purity in the choice of words, and juſtneſs of conſtruction, joined with perſpicuity, are the chief properties of this ſtyle. Accordingly Cicero ſays: "In writing letters, we make uſe of common words and expreſſions." And Seneca more fully, "I would have my letrers to be like my diſcourſes, when we either ſit or walk together, unſtudied and eaſy." And what prudent man, in his common diſcourſe, aims at bright and ſtrong figures, beautiful turns of language, or laboured periods? Nor is it always requiſite to attend to exact order and method. He that is maſter of what he writes, will naturally enough expreſs his thought without perplexity and confuſion; and more than this is ſeldom neceſſary, eſpecially in familiar letters. Letter.

Indeed, as the ſubjects of epiſtles are exceedingly various, they will neceſſarily require ſome variety in the manner of expreſſion. If the ſubject be ſomething weighty and momentous, the language ſhould be ſtrong and ſolemn; in things of a lower nature, more free and eaſy; and upon lighter matters, jocoſe and pleaſant. In exhortations, it ought to be lively and vigorous; in conſolations, kind and compaſſionate; and in adviſing, grave and ſerious. In narratives, it ſhould be clear and diſtinct; in requeſts, modeſt; in commendations, friendly; in proſperity cheerful, and mournful in adverſity. In a word, the ſtyle ought to be accommodated to the particular nature of the thing about which it is converſant.

Beſides, the different character of the perſon, to whom the letter is written, requires a like difference in the modes of expreſſion. We do not uſe the ſame language to private perſons, and thoſe in a public ſtation; to ſuperiors, inferiors, and equals. Nor do we expreſs ourſelves alike to old men and young, to the grave and facetious, to courtiers and philoſophers, to our friends and ſtrangers. Superiors are to be addreſſed to with reſpect, inferiors with courteſy, and equals with civility; and every one's character, ſtation, and circumſtances in life, with the relation we ſtand in to him, occaſions ſome variety in this reſpect. But when friends and acquaintances correſpond by letters, it carries them into all the freedom and good-humour of converſation; and the nearer it reſembles that, the better, ſince it is deſigned to ſupply the room of it. For when friends cannot enjoy each others company, the next ſatisfaction is to converſe with each other by letters. Indeed, ſometimes greater freedom is uſed in epiſtles, than the ſame perſons would have taken in diſcourſing together; becauſe, as Cicero ſays, "A letter does not bluſh." But ſtill nothing ought to be ſaid in a letter, which, conſidered in itſelf, would not have been fit to ſay in diſcourſe; though modeſty perhaps, or ſome other particular reaſon, might have prevented it. And thus it frequently happens in requeſts, reproofs, and other circumſtances of life. A man can aſk that by writing, which he could not do by words, if preſent; or blame what he thinks amiſs in his friend with greater liberty when abſent, than if they were together. From hence it is eaſy to judge of the fitneſs of any expreſſion to ſtand in an epiſtle, only by conſidering, whether the ſame way of ſpeaking would be proper in talking with the ſame perſon. Indeed, this difference may be allowed, that as perſons have more time to think, when they write, than when they ſpeak; a greater accuracy of language may ſometimes be expected in one,

Letter, Lettuce.

than the other. However, this makes no odds as to the kind of ſtyle; for every one would chooſe to ſpeak as correctly as he writes, if he could. And therefore all ſuch words and expreſſions, as are unbecoming in converſation, ſhould be avoided in letters; and a manly ſimplicity free of all affectation, plain, but decent and agreeable, ſhould run through the whole. This is the uſual ſtyle of Cicero's epiſtles, in which the plainneſs and ſimplicity of his diction is accompanied with ſomething ſo pleaſant and engaging, that he keeps up the attention of his reader, without ſuffering him to tire. On the other hand, Pliny's ſtyle is ſuccinct and witty; but generally ſo full of turns and quibbles upon the ſound of words, as apparently render it more ſtiff and affected than agrees with converſation, or than a man of ſenſe would chooſe in diſcourſe, were it in his power. You may in ſome meaſure judge of Pliny's manner, by one ſhort letter to his friend, which runs thus: "How fare you? As I do in the country? pleaſantly? that is, at leiſure? For which reaſon I do not care to write long letters, but to read them; the one as the effect of niceneſs, and the other of idleneſs. For nothing is more idle than your nice folks, or curious than your idle ones. Farewell." Every ſentence here conſiſts of an antitheſis, and a jingle of words, very different from the ſtyle of converſation, and plainly the effect of ſtudy. But this was owing to the age in which he lived, at which time the Roman eloquence was ſunk into puns, and an affectation of wit; for he was otherwiſe a man of fine ſenſe and great learning.

Letter of Attorney, in law, is a writing by which one perſon authoriſes another to do ſome lawful act in his ſtead; as to give ſeiſin of lands, to receive debts, ſue a third perſon, &c.

The nature of this inſtrument is to transfer to the perſon to whom it is given, the whole power of the maker, to enable him to accompliſh the act intended to be performed. It is either general or ſpecial: and ſometimes it is made revocable, which is when a bare authority is only given; and ſometimes it is irrevocable, as where debts, &c. are aſſigned from one perſon to another. It is generally held, that the power granted to the attorney muſt be ſtrictly purſued; and that where it is made to three perſons, two cannot execute it. In moſt caſes, the power given by a letter of attorney determines upon the death of the perſon who gave it. No letter of attorney made by any ſeamen, &c. in any ſhip of war, or having letters of marque, or by their executors, &c. in order to empower any perſon to receive any ſhare of prizes or bounty-money, ſhall be valid, unleſs the ſame be made revocable, and for the uſe of ſuch ſeamen, and be ſigned and executed before, and atteſted by, the captain and one other of the ſigning officers of the ſhip, or the mayor or chief magiſtrate of ſome corporation.

Letter of Mart or *Marque*. See Marque.

Letters Patent or *Overt*, are writings ſealed with the great ſeal of England, whereby a man is authoriſed to do, or enjoy any thing, which, of himſelf, he could not do. See Patent.—They are ſo called, by reaſon of their form; as being open, with the ſeal affixed, ready to be ſhown for the confirmation of the authority given by them.

LETTUCE, in botany. See Lactuca.

Levant ‖ Leucata.

LEVANT, in geography, ſignifies any country ſituated to the eaſt of us, or in the eaſtern ſide of any continent or country, or that on which the ſun riſes.

Levant, is alſo a name given to the eaſtern part of the Mediterranean ſea, bounded by Natolia or the Leſſer Aſia on the north, by Syria and Paleſtine on the eaſt, by Egypt and Barca on the ſouth, and by the iſland of Candia and the other part of the Mediterranean on the weſt.

LEVATOR, in anatomy, a name given to ſeveral muſcles. See Anatomy, *Table of the Muſcles*.

LEUCA, in antiquity, a geographical meaſure of length in uſe among the later Gauls; which, according to Jornandes, who calls it *leuga*, contained fifteen hundred paces, or one mile and a half. Hence the name of *league*, now reckoned at three miles; in the lower age, called *leuva*.

LEUCADENDRON, in botany: A genus of the monogynia order, belonging to the tetrandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The florets are tripetalous, with one petal of each trifid; the receptacle is a little villous; there is no proper calyx; the antheræ are almoſt coalited.

LEUCADIA, formerly called *Neritis*, a peninſula of Acarnania, (Homer); but afterwards, by cutting through the peninſula, made an iſland, as it is at this day, called *St Maura*.

LEUCAS, (anc. geog.), formerly called *Neritos* and *Neritum*, a town of Leucadia or Leucas; ſituated near a narrow neck of land, or iſthmus, on a hill facing the eaſt and Acarnania: the foot or lower part of the town was a plain lying on the ſea by which Leucadia was divided from Acarnania, (Livy); though Thucydides places Leucas more inward in the iſland, which was joined to the continent by a bridge. It was an illuſtrious city, the capital of Acarnania, and the place of general aſſembly.

LEUCATA, or Leucate, (anc. geog.); a promontory of Leucadia according to Strabo, a white rock projecting into the ſea towards Cephalenia, on which ſtood a temple of Apollo ſurnamed *Leucadius*. At his feſtival, which was annually celebrated here, the people were accuſtomed to offer an expiatory ſacrifice to the god, and to avert on the head of the victim all the calamities with which they might be threatened. For this purpoſe, they made choice of a criminal condemned to die; and leading him to the brink of the promontory, precipitated him into the ſea amidſt the loud ſhouts of the ſpectators. The criminal, however, ſeldom periſhed in the water: for it was the cuſtom to cover him with feathers, and to faſten birds to his body, which by ſpreading their wings might ſerve to break his fall. No ſooner did he touch the ſea, than a number of boats ſtationed for the purpoſe flew to his aſſiſtance, and drew him out; and after being thus ſaved, he was baniſhed for ever from the territory of Leucadia. (*Strabo*, lib. 10. p. 452.)

According to ancient authors, a ſtrange opinion concerning this promontory prevailed for ſome time among the Greeks. They imagined that the leap of Leucata was a potent remedy againſt the violence of love. Hence diſappointed or deſpairing lovers, it is ſaid, were often known to have come to Leucadia; and, having aſcended the promontory, offered ſacri-

fices

Leucippus || Leucoma.

fices in the temple, and engaged by a formal vow to perform the desperate act, to have voluntarily precipitated themselves into sea. Some are reported to have recovered from the effects of the fall; and among others mention is made § of a citizen of Buthroton, in Epirus, whose passions always taking fire at new objects, he four times had recourse to the same remedy, and always with the same success. As those who made the trial, however, seldom took any precaution to render their fall less rapid, they were generally destroyed; and women often fell victims to this act of desperation.—At Leucata was shown the tomb of Artemisia, that celebrated queen of Caria who gave so many proofs of courage at the battle of Salamis †. Inflamed with a violent passion for a young man who inflexibly refused her love, she surprised him in his sleep and put out his eyes. Regret and despair soon brought her to Leucata, where she perished in the waves notwithstanding every effort to save her ‡. Such likewise was the end of the unhappy Sappho. Forsaken by her lover Phaon, she came hither to seek relief from her sufferings, and found her death. (*Menand. ap. Strab.* lib. 10. p. 452.)

§ *Ptolem. Hephæst. ap. Phot.* p. 491.

† *Herodot.* lib. 8. cap 87.

‡ *Ptolem. Hephæst.* ibid.

LEUCIPPUS, a celebrated Greek philosopher and mathematician; first author of the famous system of atoms and vacuums, and of the hypothesis of storms; since attributed to the moderns. He flourished about 428 B. C.

LEUCOGÆUS, (anc. geog.), a hill situated between Puteoli and Neapolis in Campania, abounding in sulphur; now *l'Alumera*. Whence there were also springs called *Leucogæi fontes;* the waters of which, according to Pliny, gave a firmness to the teeth, clearness to the eyes, and proved a cure in wounds.

LEUCOJUM, Great Snow-drop: a genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the ninth order, *Spathaceæ*. The corolla is campanulated, sexpartite, the segments increased at the points, the stigma simple.

Species. 1. The vernum, or spring leucojum, has an oblong bulbous root, sending up several flat leaves six or eight inches long; and amidst them an upright, channelled, hollow, naked stalk, about a foot high, terminated by a spatha, protruding one or two white flowers on slender footstalks drooping downwards, and appearing in March. 2. The æstivum, or summer leucojum, has a large, oblong, bulbous root, crowned with several long, flat, broad leaves; and amidst them an upright, thick, hollow stalk, 15 or 18 inches high; terminated by a spatha, protruding many white flowers, on slender footstalks, drooping downwards; flowering in May. 3. The autumnale, or autumnal leucojum, hath a large oblong bulbous root, crowned with many narrow leaves, an upright, naked, hollow stalk, terminated by a spatha protruding many white flowers on long weak footstalks, hanging downwards, and flowering in autumn.

Culture. All the three species are very hardy, durable in root, and increase exceedingly by offsets, which may be separated every two or three years.

LEUCOMA, in antiquity, was a public register amongst the Athenians, in which were inserted the names of all the citizens, as soon as they were of age to enter upon their paternal inheritance.

LEUCOMA, in surgery, a distemper of the eye, otherwise called *albugo*. See Albugo, and Surgery.

Leucopetra || Leuctra.

LEUCOPETRA, (anc. geog.) so called from its white colour (Strabo); a promontory of the Bruttii, in the territory of Rhegium: the termination of the Apennine. The outmost extremity of the Bruttii, or the modern *Calabria Ultra;* as the Japygium is of the ancient Calabria, or the modern Calabria Citra.

LEUCOPETRIANS, in ecclesiastical history, the name of a fanatical sect which sprang up in the Greek and Eastern churches towards the close of the 12th century: the fanatics of this denomination professed to believe in a double Trinity, rejected wedlock, abstained from flesh, treated with the utmost contempt the sacraments of Baptism and the Lord's Supper, and all the various branches of external worship; placed the essence of religion in internal prayer alone, and maintained, as it is said, that an evil being, or genius, dwelt in the breast of every mortal, and could be expelled from thence by no other method than by perpetual supplication to the Supreme Being. The founder of this enthusiastical sect is said to have been a person called *Leucopetrus*, and his chief disciple Tychicus, who corrupted, by fanatical interpretations, several books of scripture, and particularly St Matthew's gospel.

LEUCOPHLEGMATIA, in medicine, a kind of dropsy, otherwise called *anasarca*. See (*Index* subjoined to) Medicine.

LEUCOTHOE, or Leucothea (fab. hist.), the wife of Athamus, changed into a sea deity; see Ino. She was called *Matuta* by the Romans. She had a temple at Rome, where all the people, particularly women, offered vows for their brother's children. They did not intreat the deity to protect their own children, because Ino had been unfortunate in hers. No female slaves were permitted to enter the temple; or if their curiosity tempted them to transgress this rule, they were beaten with the greatest severity. To this supplicating for other people's children, Ovid alludes in these lines;

Non tamen hanc pro stirpe sua pia mater adorat,
Ipsa parum felix visa fuisse parens. Fast. 6.

LEUCTRA, (anc. geog.), a town of Bœotia, to the west of Thebes, or lying between Plateæ and Thespiæ, where the Lacedemonians had a great defeat given them by Epaminondas and Pelopidas the Theban generals. The Theban army consisted at most but of 6000 men, whereas that of the enemy was at least thrice that number: but Epaminondas trusted most in his horse, wherein he had much the advantage, both in their quality and good management; the rest he endeavoured to supply by the disposition of his men, and the vigour of the attack. He even refused to suffer any to serve under him in the engagement, but such as he knew to be fully resolved to conquer or die. He put himself at the head of the left wing, opposite to Cleombrotus king of Sparta, and placed the main stress of the battle there; rightly concluding, that if he could break the body of the Spartans, which was but 12 men deep, whereas his own was 50, the rest would be soon put to flight. He closed his own with the sacred band, which was commanded by Pelopidas; and placed his horse in the front. His right, from which he had drawn so many men, he ordered to fall back,

Leuctra, Level.

back, in a ſlanting line, as if they declined to fight, that they might not be too much expoſed to the enemy, and might ſerve him for a corps of reſerve in caſe of need. This was the wiſe diſpoſition which the two Theban generals made of their few but reſolute forces; and which ſucceeded in every part, according to their wiſh. Epaminondas advanced with his left wing, extending it obliquely, in order to draw the enemy's right from the main body; and Pelopidas charged them with ſuch deſperate ſpeed and fury, at the head of his battalion, before they could reunite, that their horſe, not being able to ſtand the ſhock, were forced back upon their infantry, which threw the whole into the greateſt confuſion: ſo that though the Spartans were of all the Greeks the moſt expert in recovering from any ſurpriſe, yet their ſkill on this occaſion either failed them or proved of no effect; for the Thebans, obſerving the dreadful impreſſion they had made on them with their horſe, puſhed furiouſly upon the Spartan king, and opened their way to him with a great ſlaughter.

Upon the death of Cleombrotus, and ſeveral officers of note, the Spartans, according to cuſtom, renewed the fight with double vigour and fury, not ſo much to revenge his death as to recover his body, which was ſuch an eſtabliſhed point of honour as they could not give up without the greateſt diſgrace. But here the Theban general wiſely choſe rather to gratify them in that point, than to hazard the ſucceſs of a ſecond onſet; and left them in poſſeſſion of their king, whilſt he marched ſtraight againſt their other wing, commanded by Archidamus, and conſiſted chiefly of ſuch auxiliaries and allies as had not heartily engaged in the Spartan intereſt: theſe were ſo diſcouraged by the death of the king and the defeat of that wing, that they betook themſelves to flight, and were preſently after followed by the reſt of the army. The Thebans, however, purſued them ſo cloſely, that they made a ſecond dreadful ſlaughter among them; which completed Epaminondas's victory, who remained maſter of the field, and erected a trophy in memory of it. This was the concluſion of the famed battle of Leuctra, in which the Lacedemonians loſt 4000 men, and the Thebans but 300.

LEVEL, an inſtrument wherewith to draw a line parallel to the horizon, by means of which the true level, or the difference of aſcent or deſcent between ſeveral places, may be found, for conveying water, draining fens, &c.

There are ſeveral inſtruments of different contrivance and matter, invented for the perfection of levelling; all of which, for the practice, may be reduced to the following.

Air-Level, that which ſhows the line of level by means of a bubble of air incloſed with ſome liquor in a glaſs-tube of an indeterminate length and thickneſs, whoſe two ends are hermetically ſealed. When the bubble fixes itſelf at a certain mark, made exactly in the middle of the tube, the plane or ruler wherein it is fixed is level. When it is not level, the bubble will riſe to one end. This glaſs-tube may be ſet in another of braſs, having an aperture in the middle, whence the bubble of air may be obſerved. The liquor wherewith the tube is filled is oil of tartar, or aqua ſecunda; theſe not being liable to freeze as common water, nor to rarefaction and condenſation, as ſpirit of wine is. This application of a bubble of air was the invention of Dr Hooke. Level.

There is one of theſe inſtruments made with ſights, being an improvement upon that laſt deſcribed, which, by the addition of more apparatus, becomes more commodious and exact. It conſiſts of an air-level, fig. 1. about eight inches long, and ſeven or eight lines in diameter, ſet in a braſs tube, 2, with an aperture in the middle, C. The tubes are carried in a ſtrong ſtraight ruler, a foot long; at whoſe ends are fixed two ſights, 3, 3, exactly perpendicular to the tubes, and of an equal height, having a ſquare hole, formed by two fillets of braſs croſſing each other at right angles, in the middle whereof is drilled a very little hole, through which a point on a level with the inſtrument is deſcried. The braſs tube is faſtened on the ruler by means of two ſcrews; one whereof, marked 4, ſerves to raiſe or depreſs the tube at pleaſure, for bringing it towards a level. The top of the ball and ſocket is rivetted to a little ruler that ſprings, one end whereof is faſtened with ſcrews to the great ruler, and at the other end has a ſcrew, 5, ſerving to raiſe and depreſs the inſtrument when nearly level. Plate CCLXX.

The inſtrument juſt deſcribed, however, is yet leſs commodious than the following one; becauſe though the holes be ever ſo ſmall, yet they will ſtill take in too great a ſpace to determine the point of level preciſely.

The inſtrument alluded to conſiſts of an air-level, with teleſcope ſights. This level (fig. 2.) is like the laſt; with this difference, that, inſtead of plain ſights, it carries a teleſcope to determine exactly a point of level at a good diſtance. The teleſcope is a little braſs-tube, about 15 inches long, faſtened on the ſame ruler as the level. At the end of the tube of the teleſcope, marked 1, enters the little tube 1, carrying the eye-glaſs and an hair horizontally placed in the focus of the object-glaſs, 2; which little tube may be drawn out, or puſhed into the great one, for adjuſting the teleſcope to different ſights: at the other end of the teleſcope is placed the object-glaſs. The ſcrew 3, is for raiſing or lowering the little fork, for carrying the hair, and making it agree with the bubble of air when the inſtrument is level; and the ſcrew 4, is for making the bubble of air, D or E, agree with the teleſcope: the whole is fitted to a ball and ſocket. M. Huygens is ſaid to be the firſt inventor of this level; which has this advantage, that it may be inverted by turning the ruler and teleſcope half round; and if then the hair cut the ſame point that it did before, the operation is juſt.

It may be obſerved, that one may add a teleſcope to any kind of level, by applying it upon, or parallel to, the baſe or ruler, when there is occaſion to take the level of remote objects.

Dr Deſaguliers contrived an inſtrument, by which the difference of level of two places, which could not be taken in leſs than four or five days with the beſt teleſcope-levels, may be taken in as few hours. The inſtrument is as follows. To the ball C (fig. 3.) is joined a recurve tube B A, with a very fine bore, and a ſmall bubble at top A, whoſe upper part is open. It is evident from the make of this inſtrument, that if it be inclined in carrying, no prejudice will be done to the liquor, which will always be right both in the ball and tube when the inſtrument is ſet upright. If the air at C be ſo expanded with heat, as to drive the

Level. liquor to the top of the tube, the cavity A will receive the liquor, which will come down again and ſettle at D, or near it, according to the level of the place where the inſtrument is, as ſoon as the air at C returns to the ſame temperament as to heat and cold. To preſerve the ſame degree of heat, when the different obſervations are made, the machine is fixed in a tin veſſel E F, filled with water up to *g h*, above the ball, and a very ſenſible thermometer has alſo its ball under water, that one may obſerve the liquor at D, in each experiment, when the thermometer ſtands at the ſame height as before. The water is poured out when the inſtrument is carried; which one may do conveniently by means of the wooden frame, which is ſet upright by the three ſcrews, S, S, S, fig. 4. and a line and plummet P P, fig. 5. At the back part of the wooden frame, from the piece at top K, hangs the plummet P, over a braſs point at N; M *m* are brackets to make the upright board K N continue at right angles with the horizontal one at N. Fig. 6. repreſents a front view of the machine, ſuppoſing the fore part of the tin-veſſel tranſparent; and here the braſs-ſocket of the recurve-tube, into which the ball is ſcrewed, has two wings at I I, fixed to the bottom, that the ball may not break the tube by its endeavour to emerge when the water is poured in as high as *g h*.

After the Doctor had contrived this machine, he conſidered, that as the tube is of a very ſmall bore, if the liquor ſhould riſe into the ball at A (fig. 3.) in carrying the inſtrument from one place to another, ſome of it would adhere to the ſides or the ball A, and upon its deſcent in making the experiment, ſo much might be left behind, that the liquor would not be high enough at D to ſhow the difference of the level: therefore, to prevent that inconveniency, he contrived a blank ſcrew, to ſhut up the hole at A, as ſoon as one experiment is made, that, in carrying the machine, the air in A may balance that in C, ſo that the liquor ſhall not run up and down the tube, whatever degree of heat and cold may act upon the inſtrument, in going from one place to another. Now, becauſe one experiment may be made in the morning, the water may be ſo cold, that when a ſecond experiment is made at noon the water cannot be brought to the ſame degree of cold it had in the morning; therefore, in making the firſt experiment, warm water muſt be mixed with the cold, and when the water has ſtood ſome time, before it comes to be as cold as it is likely to be at the warmeſt part of that day, obſerve and ſet down the degree of the thermometer at which the ſpirit ſtands, and likewiſe the degree of the water in the barometer at D; then ſcrew on the cape at A, pour out the water, and carry the inſtrument to the place whoſe level you would know; then pour in your water, and when the thermometer is come to the ſame degree as before, open the ſcrew at top, and obſerve the liquor in the barometer.

The Doctor's ſcale for the barometer is ten inches long, and divided into tenths; ſo that ſuch an inſtrument will ſerve for any heights not exceeding ten feet, each tenth of an inch anſwering to a foot in height.

The Doctor made no allowance for the decreaſe of denſity in the air, becauſe he did not propoſe this machine for meaſuring mountains (though, with a proper allowance for the decreaſing denſity of the air, it will do very well), but for heights that want to be known in gardens, plantations, and the conveyance of water, where an experiment that anſwers two or three feet in a diſtance of 20 miles, will render this a very uſeful inſtrument. Level.

*Artillery Foot-*LEVEL is in form of a ſquare, having its two legs or branches of an equal length; at a juncture whereof is a little hole, whence hangs a thread and plummet playing on a perpendicular line in the middle of a quadrant. It is divided into twice 45 degrees from the middle. Fig. 7.

This inſtrument may be uſed on other occaſions, by placing the ends of its two branches on a plane; for when the thread plays perpendicularly over the middle diviſion of the quadrant, that plane is aſſuredly level. To uſe it in gunnery, place the two ends on the piece of artillery, which you may raiſe to any propoſed height, by means of the plummet, whoſe thread will give the degree above the level.

Carpenter's and Pavior's LEVEL, conſiſts of a long ruler, in the middle whereof is fitted, at right angles, another ſomewhat bigger, at the top of which is faſtened a line, which, when it hangs over a ſiducial line at right angles with the baſe, ſhows that the ſaid baſe is horizontal. Sometimes this level is all of one board. Fig. 8.

Gunner's LEVEL, for levelling cannons and mortars, conſiſts of a triangular braſs plate, about four inches high, fig. 9. at the bottom of which is a portion of a circle, divided into 45 degrees; which number is ſufficient for the higheſt elevation of cannons and mortars, and for giving ſhot the greateſt range: on the centre of this ſegment of a circle is ſcrewed a piece of braſs, by means of which it may be fixed or ſcrewed at pleaſure: the end of this piece of braſs is made ſo as to ſerve for a plummet and index, in order to ſhow the different degrees of elevation of pieces of artillery. This inſtrument has alſo a braſs foot, to ſet upon cannons or mortars, ſo as, when thoſe pieces are horizontal, the inſtrument will be perpendicular. The foot of this inſtrument is to be placed on the piece to be elevated, in ſuch a manner, as that the point of the plummet may fall on the proper degree: this is what they call *levelling the piece*.

Maſon's LEVEL, is compoſed of three rules, ſo joined as to form an iſoſceles-rectangle, ſomewhat like a Roman A; at the vertex whereof is faſtened a thread, from which hangs a plummet, that paſſes over a ſiducial line, marked in the middle of the baſe, when the thing to which the level is applied is horizontal; but declines from the mark, when the thing is lower on the one ſide than on the other.

Plumb or *Pendulum* LEVEL, that which ſhows the horizontal lines by means of another line perpendicular to that deſcribed by a plummet or pendulum. This inſtrument, fig. 10. conſiſts of two legs or branches, joined together at right angles, whereof that which carries the thread and plummet is about a foot and a half long; the thread is hung towards the top of the branch, at the point 2. The middle of the branch where the thread paſſes is hollow, ſo that it may hang free every where: but towards the bottom, where there is a little blade of ſilver, whereon is drawn a line perpendicular to the teleſcope, the ſaid cavity is covered by two pieces of braſs, making as it were a kind of caſe, leſt the wind ſhould agitate the thread; for which reaſon the ſilver blade is covered with a glaſs G, to the

end

Level. end that it may be ſeen when the thread and plummet play upon the perpendicular: the teleſcope is faſtened to the other branch of the inſtrument, and is about two feet long; having an hair placed horizontally acroſs the focus of the object-glaſs, which determines the point of the level. The teleſcope muſt be fitted at right angles to the perpendicular. It has a ball and ſocket, by which it is faſtened to the foot, and was invented by M. Picard.

Reflecting Level, that made by means of a pretty long ſurface of water repreſenting the ſame object inverted which we ſee erected by the eye, ſo that the point where theſe two objects appear to meet is a level with the place where the ſurface of the water is found. This is the invention of M. Marriotte.

There is another reflecting level conſiſting of a mirror of ſteel, or the like, well poliſhed, and placed a little before the object-glaſs of a teleſcope, ſuſpended perpendicularly. This mirror muſt make an angle of 45° with the teleſcope, in which caſe the perpendicular line of the ſaid teleſcope is converted into a horizontal line, which is the ſame with the line of level. This is the invention of M. Caſſini.

*Water-*Level, that which ſhows the horizontal line by means of a ſurface of water or other liquor; founded on this principle, that water always places itſelf level.

The moſt ſimple is made of a long wooden trough or canal, whoſe ſides are parallel to the baſe; ſo that being equally filled with water, its ſurface ſhows the line of level. This is the chorobates of the ancients. See Chorobata.

It is alſo made with two cups fitted to the two ends of a pipe, three or four feet long, about an inch in diameter, by means whereof the water communicates from the one to the other cup; and this pipe being moveable on its ſtand by means of a ball and ſocket, when the two cups become equally full of water, their two ſurfaces mark the line of level.

This inſtrument, inſtead of cups, may alſo be made with two ſhort cylinders of glaſs three or four inches long, faſtened to each extreme of the pipe with wax or maſtic. Into the pipe is poured ſome common or coloured water, which ſhows itſelf through the cylinders, by means whereof the line of level is determined; the height of the water, with reſpect to the centre of the earth, being always the ſame in both cylinders; this level, though very ſimple, is yet very commodious for levelling ſmall diſtances.

Level of Mr Huygens's invention, conſiſts of a teleſcope *a*, fig. 11. in form of a cylinder, going through a ferril, in which it is faſtened by the middle. This ferril has two flat branches *bb*, one above, and the other below: at the ends whereof are faſtened little moving pieces, which carry two rings, by one of which the teleſcope is ſuſpended to an hook at the end of the ſcrew 3, and by the other a pretty heavy weight is ſuſpended, in order to keep the teleſcope *in æquilibrio*. This weight hangs in the box 5, which is almoſt filled with linſeed oil, oil of walnuts, or other matter that will not eaſily coagulate, for more aptly ſettling the balance of the weight and teleſcope. The inſtrument carries two teleſcopes cloſe and very parallel to each other; the eye-glaſs of the one being againſt the object glaſs of the other, that one may ſee each way without turning the level. In the focus of the object-glaſs of each teleſcope muſt a little hair be ſtrained horizontally, to be raiſed and lowered as occaſion requires by a little ſcrew. If the tube of the teleſcope be not found level when ſuſpended, a ferril or ring, 4, is put on it, and is to be ſlid along till it fixes to a level. The hook on which the inſtrument is hung is fixed to a flat wooden croſs; at the ends of each arm whereof there is a hook ſerving to keep the teleſcope from too much agitation in uſing or carriage. To the ſaid flat croſs is applied another hollow one, that ſerves as a caſe for the inſtrument; but the two ends are left open, that the teleſcope may be ſecured from the weather and always in a condition to be uſed. The foot of this inſtrument is a round braſs plate, to which are faſtened three braſs ferrils, moveable by means of joints whereon are put ſtaves, and on this foot is placed the box. Level.

Fig. 12. marked I, is a balance-level; which being ſuſpended by the ring, the two ſights, when *in æquilibrio*, will be horizontal, or in a level.

Spirit Level. The moſt accurate levelling inſtrument, and that poſſeſſed of the greateſt eſſential advantages in uſe, is the ſpirit-level; which was firſt conſtructed by the late Mr Siſſon, and to which ſome ſmall additions and improvements have been ſince made. The following is a deſcription of one of the beſt of theſe levels, as made by the principal mathematical inſtrument makers.

Fig. 13. is a repreſentation of the inſtrument mounted on its complete ſtaves, copied (except the letters) from Mr Adams's Graphical Eſſays, Plate xvii. fig. 3. The teleſcope (ABC) is made from 15 inches to 2 feet in length, as may be required. It is achromatic, of the beſt kind, and ſhows the objects erect. In the focus of the eye-glaſſes are exceedingly fine croſs wires, the interſection of which is evidently ſhown to be perfectly in the axis of the tube; for by turning it round on its two ſupporters DE, and looking through the teleſcope, the interſection of the wires will conſtantly cut the ſame part of the object viewed. By turning the ſcrew *a* at the ſide of the teleſcope, the object-glaſs at *g* is moved; and thus the teleſcope is exactly adapted to the eye. If theſe croſs wires are at any time out of their adjuſtment, which is diſcovered by their interſection not cutting the ſame part of the object during the revolution of the teleſcope on its axis, they are eaſily adjuſted by means of the four ſcrews *bbb*, placed on the teleſcope about an inch from the end for the eye. Theſe ſcrews act in perpendicular directions to one another, by unſcrewing one and tightening the other oppoſite to the wire, ſo that if connected with it, it may be moved either way at pleaſure; and in this manner the other wire perpendicular to it may be moved, and thus the interſection of the wires brought exactly in the axis of the tube.

To the teleſcope is fixed, by two ſmall ſcrews *cc*, the level tube containing the ſpirits, with a ſmall bubble of air: This bubble of air, when the inſtrument is well adjuſted, will ſettle exactly in the ſame place, in or near the middle of its tube, whether the teleſcope be reverſed or not on the ſupporters, which in this caſe are kept unmoved.

It is evident, that the axis of the teleſcope, or the interſection of the wires, as before ſhown, muſt be in this

LEVELS.

Plate CCLXX.

Fig. 1.

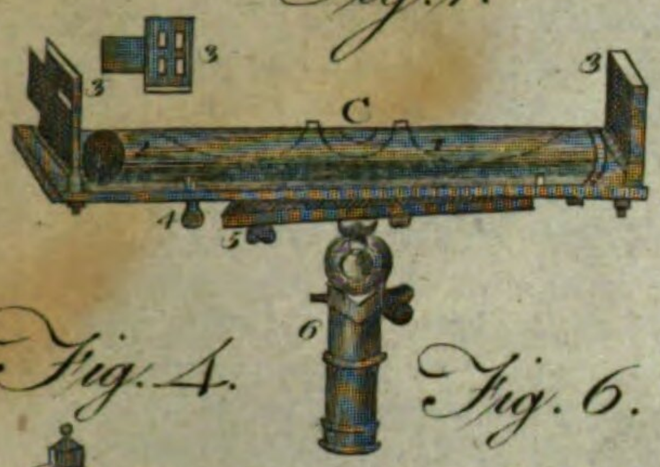


Fig. 2.

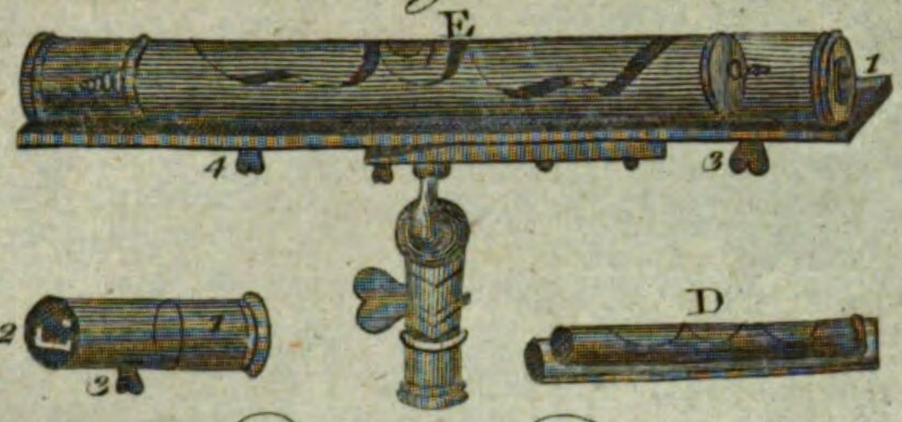


Fig. 3.

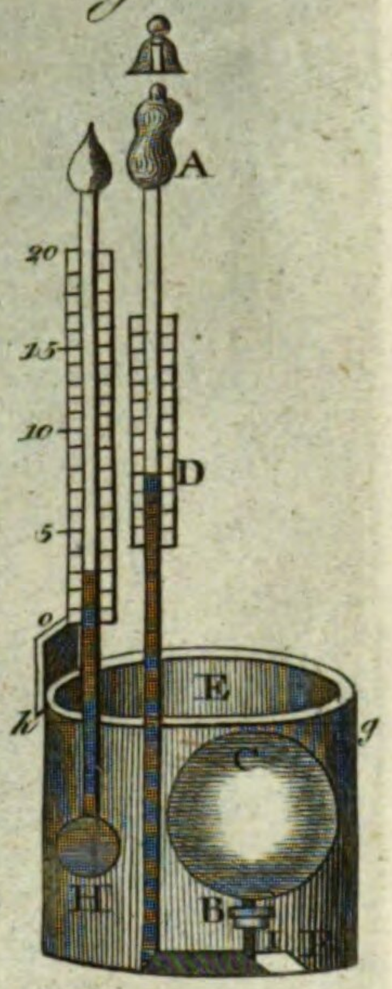


Fig. 4.

Fig. 6.

Fig. 14.

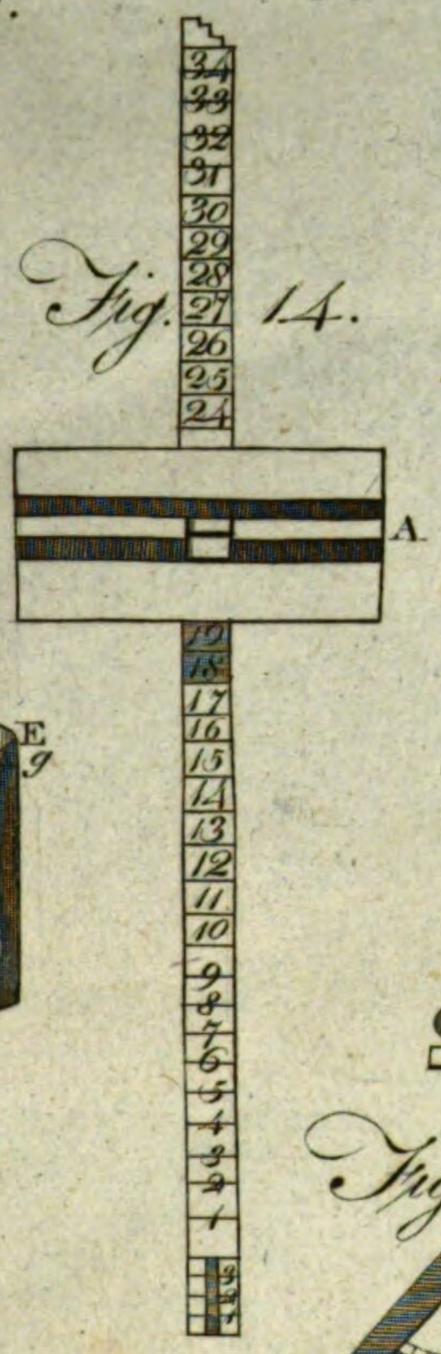


Fig. 5.

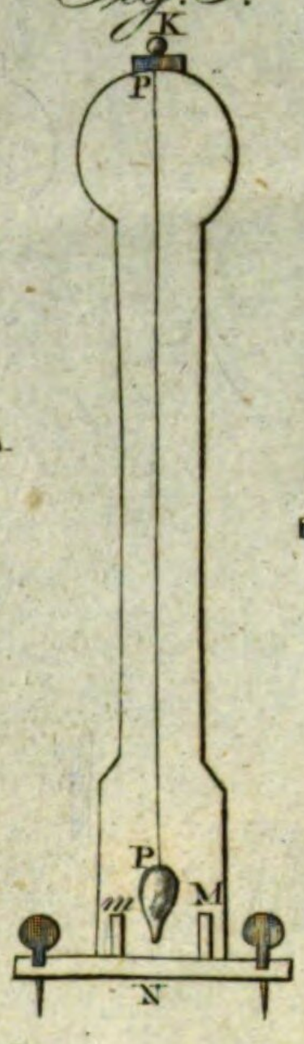


Fig. 9.

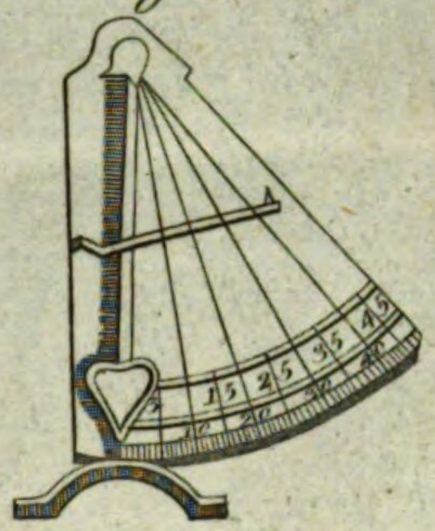


Fig. 8.

Fig. 10.

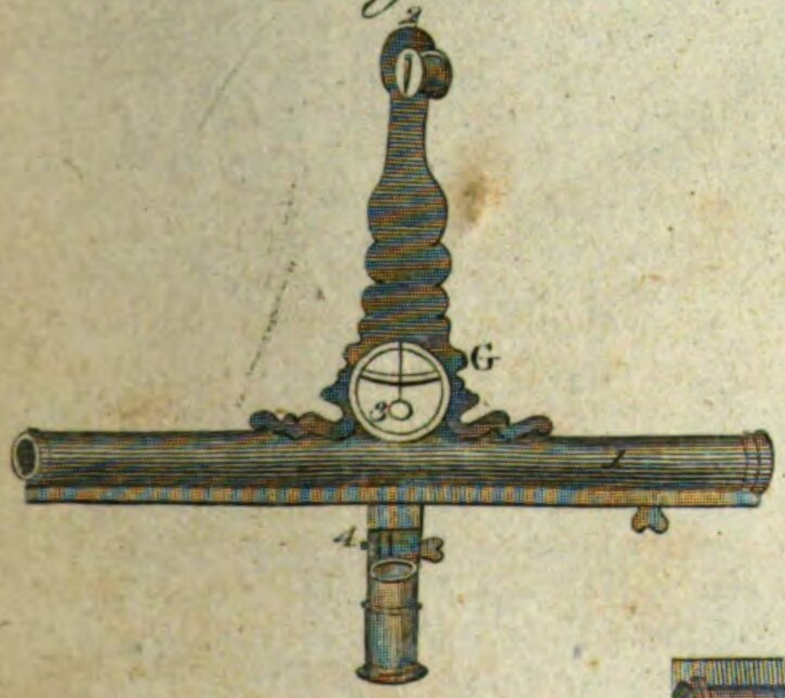


Fig. 7.

Fig. 11.

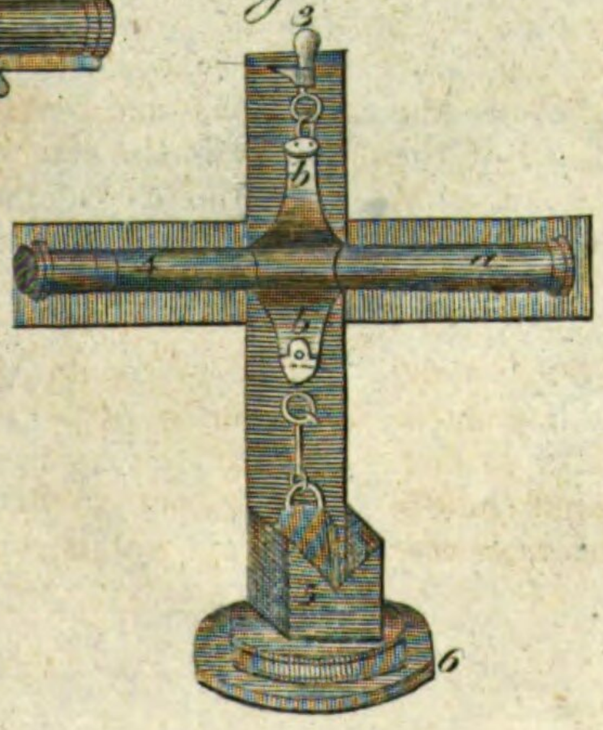
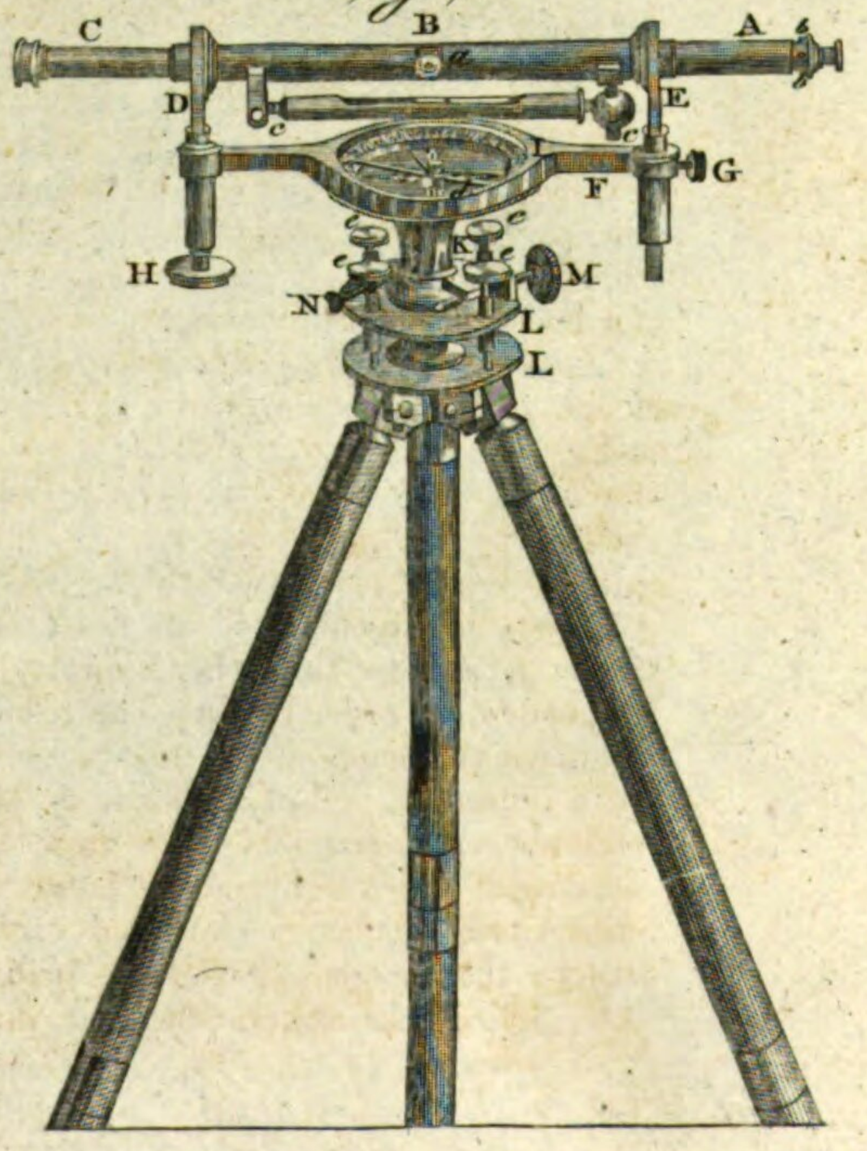


Fig. 12.

Fig. 13.



A. Bell Prin. Wal. Sculptor fecit.

Level. case truly level. In this facile mode of adjuſtment conſiſts the new improvement of the inſtrument; and it is hereby capable of being adjuſted by only one ſtation and one object, which will at the ſame time determine it to be in a true level. If by change of weather, accident, or otherwiſe, the inſtrument ſhould have loſt its level adjuſtment or ſtate, it may thus be readily reſtored and readjuſted at the firſt ſtation; which is an advantage none of the inſtruments formerly made have been capable of. The two ſupporters DE, on which the level reſts and turns, are ſhaped like the letter Y. The teleſcope reſts within the upper part of them; and the inner ſides of each of theſe Ys are tangents to the cylindric tube of the teleſcope, which is turned to a true cylinder, and each touches it but at one place only.

The lower end of theſe ſupporters are inſerted into a ſtrong braſs plate (FE), and ſo as to ſtand perpendicularly on it. One is kept faſt by a tightening ſcrew G, and to the other is applied a fine threaded ſcrew H, to adjuſt the tube when on its ſupporters to a true level. To the ſupporter D is ſometimes applied a line of tangents as far as 12 degrees, in order to take an angle of depreſſion or elevation to that extent. Between the ſupporters is alſo ſometimes fixed a compaſs-box I, divided into 360 degrees, and again into four 90°; having a centre pin and needle, and trigger, at *d*, to throw off the needle from the centre when not uſed; ſo in this manner it conſtitutes a perfect circumferenter, connected with all the foregoing improvements. This plate is fixed on a conical braſs ferrel K, which is adapted to the bell-metal fruſtum of a cone at top of the braſs head of the ſtaves, having a ball and ſocket, with three bell-metal joints, two ſtrong braſs parallel plates LL, the four ſcrews *eeee* for adjuſting the horizontal motion, a regulating ſcrew M to this motion, and a faſtening ſcrew N to lighten it on the cone when neceſſary. The faſtening ſcrew N, and the regulating ſcrew M, by which the whole inſtrument is moved with accuracy through a ſmall ſpace in an horizontal direction, was an addition of Mr Ramſden's.

The manner of adjuſting the ſpirit-level at the firſt ſtation. The whole level being now placed ſteadily on its ſtaves, it muſt be rendered parallel to the axis of the teleſcope before you adjuſt the horizontal motion. To this end the teleſcope muſt be placed in a line with two of the ſcrews *ee*, and then levelled thereby till the bubble of air in the ſpirit-tube keeps its poſition in the middle, while turned about to three points, making nearly right angles at the centre to one another.

The horizontal motion being thus adjuſted, the rims *ff* of the Ys are to be opened, the teleſcope taken off and laid the contrary way upon the ſupporters. If the bubble of air then reſts exactly the ſame, the level and teleſcope are adjuſted rightly to one another; but if the bubble does not remain the ſame, the end to which the air bubble goes muſt be noticed, and the diſtance of it from the teleſcope altered; correcting one half the error by the ſcrews *ee*, and the other half by the ſcrews *ee*.

Now the interſection of the wires being directed to any diſtant object, it may be one of the vanes of the ſtaves hereafter deſcribed: if they continue to be againſt it preciſely while the teleſcope is turned round on its Ys, it proves, as before mentioned, that the axis of the teleſcope coincides with the interſection of the wires, and that the inſtrument will give the true level direction. Levelling.

The operation of levelling being of a very accurate and important nature, and the beſt inſtrument when out of its adjuſtment being of little uſe, it is quite neceſſary that every perſon uſing ſuch an inſtrument ſhould have it readily in his power to correct it; and the one above deſcribed appears to be the beſt adapted for that purpoſe of any hitherto contrived.

LEVELLING may be defined, the art which inſtructs us in finding how much higher or lower any given point on the ſurface of the earth is than another; or, in other words, the difference in their diſtance from the centre of the earth.

The practice of levelling therefore conſiſts, 1. In finding and marking two or more points that ſhall be in the circumference of a circle whoſe centre is that of the earth. 2. In comparing the points thus found with other points, to aſcertain the difference in their diſtances from the earth's centre.

With regard to the theory of levelling, we muſt obſerve, that a plumb-line, hanging freely in the air, points directly towards the centre of the earth; and a line drawn at right angles, croſſing the direction of the plumb-line, and touching the earth's ſurface, is a true level only in that particular ſpot; but if this line which croſſes the plumb be continued for any conſiderable length, it will riſe above the earth's ſurface, and the apparent level will be above the true one, becauſe the earth is globular; and this riſing will be as the ſquare of the diſtance to which the ſaid right line is produced; that is to ſay, however much it is raiſed above the earth's ſurface at one mile's diſtance, it will riſe four times as much at the diſtance of two miles, nine times at the diſtance of three, &c. This is owing to the globular figure of the earth; and this riſing is the difference betwixt the true and apparent levels; the real curve of the earth being the true level, and the tangent to it the apparent level. Hence it appears, that the leſs diſtance we take betwixt any two ſtations, the truer will be our operations in levelling; and ſo ſoon does the difference betwixt the true and apparent levels become perceptible, that it is neceſſary to make an allowance for it if the diſtance betwixt the two ſtations exceeds two chains in length. The following is an infallible rule for determining the allowance to be made:

"Multiply the number of Gunter's decimal ſtatute chains that are contained in length between any two ſtations where the levels are to be taken by itſelf, and the product ariſing therefrom again by 124; which is a common multiplier for all manner of diſtances for this purpoſe on account of the earth's curvature: then divide the ſecond product ariſing therefrom by 100,000; or, which is alſo the ſame, with the daſh of the pen cut off five figures on the right hand ſide of the product, and what remains on the left ſide is inches, and the five figures cut off decimal parts of an inch." *Leach's Inland navigation.*

Levelling. The following is *A Table of Curvature of the Earth* and ſhows the quantity below the apparent level at the end of every number of chains to 100.

Chains.	Inches.	Chains.	Inches.	Chains.	Inches.	Chains.	Inches.
1	0.00125	14	0.24	27	0.91	40	2.00
2	0.005	15	0.28	28	0.98	45	2.28
3	0.01125	16	0.32	29	1.05	50	3.12
4	0.02	17	0.36	30	1.12	55	3.78
5	0.03	18	0.40	31	1.19	60	4.50
6	0.04	19	0.45	32	1.27	65	5.31
7	0.06	20	0.50	33	1.35	70	6.12
8	0.08	21	0.55	34	1.44	75	7.03
9	0.10	22	0.60	35	1.53	80	8.00
10	0.12	23	0.67	36	1.62	85	9.03
11	0.15	24	0.72	37	1.71	90	10.12
12	0.18	25	0.78	38	1.80	95	11.28
13	0.21	26	0.84	39	1.91	100	12.50

evelling is either ſimple or compound. The former is when the level points are determined from one ſtation, whether the level be fixed at one of the points or between them. Compound levelling is nothing more than a repetition of many ſimple operations.

An example of ſimple levelling is given Plate CCLXXI. fig. 1. where A B are the ſtation points of the level; C D the two points aſcertained. Let the height

	Feet.	Inches.
From A to C be -	6	0 0
From B to D be -	9	0 0
The difference -	3	0 0

ſhows that B is three fe t lower than A.

If the ſtation-points of the level are above the line of ſight, as in fig. 2. and the diſtance from A to C be ſix feet, and from B to D nine feet, the difference will ſtill be three feet which B is higher than A.

As an example of compound levelling, ſuppoſe it were required to know the difference of height between the point A on the river *Zome*, and N on the river *Belann*, fig. 3. (As our author could find no ſatiſfactory examples in any Engliſh author, he copied this and the following ones from M. le Febure). In this operation ſtakes ſhould be driven down at A and N, exactly level with the ſurface of the water; and theſe ſtakes ſhould be ſo fixed, that they may not be changed until the whole operation be finiſhed: a plan of the ground between the two rivers ſhould then be made, by which it will be diſcovered, that the ſhorteſt way between the rivers is by the dotted line AC, CH, HN; from whence alſo the number of ſtations neceſſary to be taken will be determined. The operator will alſo be enabled to diſtribute them properly according to the nature and ſituation of the ground. In the figure 12. ſtations are marked. Stakes ought then to be driven in at the limits of each ſtation, as A, B,C,D, &c. They ought to be about two or three inches above the ground, and driven 18 inches into it. Stakes ſhould alſo be driven in at each ſtation of the inſtrument, as 1, 2, 3, 4, &c.

Levelling. The operation may be begun in the following manner. Let the firſt ſtati n be at 1, equally diſtant from the two points A and B, which themſelves are diſtant 166 yards. Write down then in one column the firſt limit A; in another, the number of feet, inches, and tenths; with the points of ſight indicated on the ſtation-ſtaff at A, viz. 7. 6. 0. In the third column, the ſecond limit B; in the fourth, the height indicated at the ſtation-ſtaff B, viz. 6. 0. 0. Laſtly, in the fifth co lumn, the diſtance from one ſtation-ſtaff to the other; which in this caſe is 166 yards. Remove now the level to the point marked 2, which is in the middle between B and C, the two places where the ſtation-ſtaves are to be held; obſerving that B, which was the ſecond limit in the former operation, is the firſt in this. Then write down the obſerved heights as before; in the firſt column B; in the ſecond 4. 6. 0; in the third C; in the fourth 5. 6. 2; in the fifth 560, the diſtance between B and C.

It being impoſſible, on account of the inequality of the ground at the third ſtation, to place the inſtrument in the middle between the two ſtation-ſtaves, find the moſt convenient point as at 3; then meaſure exactly how far this is from each ſtation-ſtaff, and you will find that from 3 to C is 160 yards; from 3 to D, 80 yards; and the remainder of the operation will be as in the preceding ſtation.

In the fourth operation, we muſt endeavour to compenſate for any error which might have happened in the laſt. Mark out, therefore, 80 yards from the ſtation-ſtaff D to the point 4; and 160 yards from 4 to E; and this muſt be carefully attended to, as by ſuch compenſations the work may be much facilitated. Proceed in the ſame manner with the eight remaining ſtations, obſerving to enter every thing in its proper column; and when the whole is finiſhed, add the ſums of each column together, and then ſubtract the leſſer from the greater; the difference, which in the preſent caſe is 5. 4. 8. ſhows the ground at N to be thus much lower than the ground at A.

To obtain a ſection of this level, draw the dotted line *o o*, fig. 4. either above or below the plan; which may be taken for the level or horizontal line. Let fall then perpendiculars upon this line from all the ſtation-points and places where the ſtation-ſtaves were fixed. Beginning now at A, ſet off 7 feet 6 inches upon the line from A to *a*: for the height of the level-point determined on the ſtaff at this place, draw a line through *a* parallel to the dotted line *o o*, which will cut the third perpendicular at *b*, the ſecond ſtation-ſtaff. Set off from this point downwards ſix feet to B, which ſhows the ſecond limit of the firſt operation; and that the ground at B is one foot ſix inches higher than at A: place your inſtrument between theſe two lines at the height of the level line, and trace the ground according to its different heights. Now ſet off, on the ſecond ſtation-ſtaff B, four feet ſix inches to C, the height determined by the level at the ſecond ſtation; and from C draw a line parallel to *o o*, which will cut the fifth perpendicular at *d*, the third ſtation-ſtaff. From this point ſet off 5 feet 6 inches $\frac{7}{10}$ downwards to C, which will be our ſecond limit with reſpect to the preceding one and the third with reſpect to the firſt. Then draw your inſtrument in the middle between B and C, and delineate the ground with its inequalities. Proceed

Levelling. ceed in the ſame manner from ſtation to ſtation, till you arrive at the laſt N, and you will have the profile of the ground over which the level was taken.

This method anſwers very well where only a general profile of the different ſtations is required; but where it is neceſſary to have an exact detail of the ground between the limits, we muſt then go to work more particularly. Suppoſe, therefore, the level to have been taken from A to N by another route, but on more uniform ground, in order to form a canal marked O, P, Q, R, S, T, U, X, Y. Draw at pleaſure a line Z, Y, fig. 5. to repreſent the level, and regulate the reſt; then let fall on this line perpendiculars to repreſent the ſtaves at the limits of each ſtation, taking care that they be fixed accurately at their reſpective diſtances from each other. The difference between the extreme limits, in this caſe, ought to be the ſame as in the former, *viz.* 5 feet 4 inches $\frac{6}{10}$. Set off this meaſure upon the perpendicular *o* the firſt limit; and from *o*, prolonging the perpendicular, mark off at *a* the height determined at the firſt ſtation-ſtaff; then do the ſame with the ſecond and third, and ſo on with the following, till this part of the work is finiſhed; there remains then only to delineate in detail the ground between the ſtation-ſtaves, the diſtances in this example being aſſumed larger on account of the detail.

To obtain the ſection of the ground between O and P, place your inſtrument at one of the limits, as P, fixing it ſo that the croſs hairs may anſwer to the point C; then look towards the firſt limit *o*, raiſing or depreſſing the vane till it coincides with the interſection of the croſs hairs; and the line of ſight from one point to the other will mark the level or horizontal line.

To ſet off the height of the brink of the river above the firſt limit, drive a ſtake down cloſe to the ground at *a*; and place your ſtation-ſtaff upon it, obſerving where the hairs interſect the vane, which will be at 4 feet 10 inches; then, laying off upon the line *oz* the diſtance from the firſt to the laſt ſtake, let fall from thence a perpendicular, and ſet off thereon 4. 10. 0 to *a*, which gives the height at the firſt ſtake; or, which is the ſame, the height from the edge of the river above the ſurface of the water, as is evident from the ſection. Drive a ſecond ſtake at 6, in a line between the limits; place the ſtation-ſtaff upon this ſtake, and obſerve the height 4. 6. interſected by the croſs hairs, the inſtrument ſtill remaining in the ſame ſituation. Set off on the level-line the diſtance from the firſt ſtake *a* to the ſecond *b*; and then let fall a perpendicular, and mark upon it 4. 6 to *b*, which gives the height of the ground at this place.

The ſmall hollow *c* is marked out by driving down a third ſtake even with the ground, in the middle of it at *c*; but the exact diſtance of the ſecond ſtake *b* from the third *c*, muſt be marked upon the level line: then let fall a perpendicular from *c*, and ſet off upon it 6. 8. 0, pointed out by the croſs hairs on the ſtaff, which determines the depth of the hollow, as appears from the figure. As the diſtances between the ſtakes are now very ſhort, they can eaſily be marked by the operator, who can ſettle any little inequalities by a compariſon with thoſe already aſcertained. Proceed thus with the other ſtations till you arrive at the laſt, and you will always obtain an accurate ſection of your work; by which it is eaſy to form a juſt eſtimation of the land to be dug away, in order to form the canal, by adding the depth to be given to it. Levelling.

Fig. 6. gives an example of compound levelling, where the ſituation is ſo ſteep and mountainous, that the ſtaves cannot be placed at equal diſtances from the inſtrument, or where it is even impoſſible to make a reciprocal levelling from one ſtation to the other. Thus ſuppoſe the point K to be the bottom of a baſon where it is required to make a fountain, the reſervoir being at A; ſo that, in order to know the height to which the jet d'eau will riſe, it is neceſſary to know how high the point A is above K.

In great heights ſuch as this, it will be neceſſary to proceed by ſmall deſcents, as from A to D. The inſtrument muſt be adjuſted with all poſſible care; and it will even be proper, in ſome part of the work, to uſe a ſmaller inſtrument. The following is a table of the different operations uſed in making this level, it having been taken from M. le Febure's practice.

	feet.	in.		feet.	in.	yards.
A	21	6	C	0	9	90
C	4	3	D	0	3	40
D	3	9	E	16	3	350
E	5	0	F	17	9	250
F	10	6	G	5	0	375
G	5	0	H	19	0	300
H	5	0	K	47	3	1000
	95	0		106	9	2405

In this caſe only two levellings are made between A and D, though more would have been neceſſary; but they are omitted to avoid confuſion. In the fourth ſtation the height found was 16 feet 8 inches; but on account of the great length, it was requiſite to reduce the apparent level to the true one, which is always neceſſary where the length is conſiderable. At the laſt limit we get the height from N to *o*; then from *a* to I; from I to K, fig. 7. &c.; all which added together, and then corrected for the curvature, gives 47 feet 3 inches. Now, by adding each column together, and ſubtracting one from the other, we have 51 feet 9 inches for the height which the point A is above the bottom of the baſon, and which will cauſe the jet d'eau to riſe about 45 feet. The general ſection of this operation is ſhown at fig. 7, 8. but an exact profile of the mountain is more difficult, as requiring many operations; though ſome of theſe might be obtained by meaſuring from the level line without moving the inſtrument.

The laſt example given by our author is likewiſe from M. le Febure, and includes a length of near five German miles (25 of ours) in a ſtraight line, and 9 or 10 (45 or 50 Engliſh) including the turnings and windings. In this the declivity of the river *Haynox* was meaſured from Lignebruk to Villebourg. The firſt operation was to drive ſtakes at ſeveral parts of the river even with the water's edge; the firſt of which a little above the mills of Lignebruk ſhowed the upper water-mark, and another ſhowed the lower water-mark at the ſame mills. Two ſtakes above and below the mills of Mazurance, ſomewhat more than half way between Lignebruk and Villebourg, pointed

Levelling ‖ Lever.

out the difference between high and low water there, and formed likewiſe the third and fourth limits of the operation; while the ſtakes above and below the mills of Villebourg pointed out the difference between high and low water, and likewiſe formed the laſt limits of the operation.

Theſe marks were all made at the edge of the water, exactly even with its ſurface, and all made at the different parts of the river nearly at the ſame inſtant of time. "The principal limits of the levelling (ſays Mr Adams) being now determined and fixed, it only remains to find the level between the limits, according to the methods already pointed out, uſing every advantage that may contribute to the ſucceſs of the work, and at the ſame time avoiding all obſtacles and difficulties that may retard or injure the operations. The firſt rule is always to take the ſhorteſt poſſible way from one limit to another, though this rule ought not to be followed if there are conſiderable obſtacles in the way, as hills, woods, marſhy ground, or if, by going aſide, any advantage can be obtained." In the preſent caſe it was found neceſſary to deviate very conſiderably from the general rule, in order to take in ſeveral ponds, the ſurfaces of which might all be taken for a perfect level; and thus levels were frequently taken acroſs the country for a conſiderable way. The difference of height between the mills of Lignebruk and Villebourg was at laſt found to be about 19 feet, indicating a deſcent of not quite a foot in a mile.

Levelling-Staves, inſtruments uſed in levelling, ſerving to carry the marks to be obſerved, and at the ſame time to meaſure the heights of thoſe marks from the ground. They uſually conſiſt of two mahogany ſtaves ten feet long, in two parts, that ſlide upon one another to about $5\frac{1}{10}$ feet, for the more portable carriage. They are divided into 1000 equal parts, and numbered at every tenth diviſion by 10, 20, 30, &c. to 1000; and on one ſide the feet and inches are alſo ſometimes marked.

Plate CCLXX. fig. 14.

A vane A ſlides up and down upon each ſet of theſe ſtaves, which by braſs ſprings will ſtand at any part. Theſe vanes are about 10 inches long and 4 inches broad; the breadth is firſt divided into three equal parts, the two extremes painted white, the middle ſpace divided again into three equal parts, which are leſs; the middle one of them is alſo painted white, and the two other parts black; and thus they are ſuited to all the common diſtances. Theſe vanes have each a braſs wire acroſs a ſmall ſquare hole in the centre, which ſerve to point out the height correctly, by coinciding with the horizontal wire of the teleſcope of the level.

LEVEN, a river of Lenox or Dunbartonſhire in Scotland. See Lenox.

LEVER, in mechanics, is a bar of iron or wood, one part of which being ſupported by a prop, all other parts turn upon that prop as their centre of motion. This inſtrument is of two kinds. Firſt, the common ſort, where the weight we deſire to raiſe, reſts at one end of it, our ſtrength is applied at the other end, and the prop is between both. When we ſtir up the fire with a poker, we make uſe of this lever; the pocker is the lever, it reſts upon one of the bars of the grate as a prop, the incumbent fire is the weight to be overcome, and the other end held in the hand is the ſtrength or power. In this as in all the reſt, we have only to increaſe the diſtance between the ſtrength and prop to give the man that works the inſtrument greater power. Leveret, Levigation.

The lever of the ſecond kind, has the prop at one end, the ſtrength is applied to the other, and the weight to be raiſed reſts between them. Thus in raiſing the water-plug in the ſtreets, the workman puts his iron lever through the hole of the plug till he reaches the ground on the other ſide, and, making that his prop, lifts the plug with his ſtrength at the other end of the lever. In this lever alſo, the greater the diſtance of the prop from the ſtrength, the greater is the workman's power.

Theſe inſtruments, as we ſee, aſſiſt the ſtrength; but ſometimes a workman is obliged to act at a diſadvantage, in raiſing either a piece of timber or a ladder upon one end. We cannot, with grammatical propriety, call this a *lever*, ſince ſuch a piece of timber in fact in no way contributes to raiſe the weight. In this caſe, the man, who is the ſtrength or power, is in the middle, the part of the beam already raiſed is the weight, the part yet at the ground is the prop on which the beam turns or reſts. Here the man's ſtrength will be diminiſhed, in proportion to the weight it ſuſtains. The weight will be greater the farther it is from the prop, therefore the man will bear the greater weight the nearer he is to the prop. See Mechanics.

LEVERET, among ſportſmen, denotes a hare in the firſt year of her age.

LEVIGATION, in pharmacy and chemiſtry, the reducing hard and ponderous bodies to an impalpable powder, by grinding them on a porphyry, or in a mill. See Chemistry, n° 599.

A new method of reducing powders to a great degree of fineneſs has lately been invented by means of a fanner. This has the advantage over the other methods, in being much more expeditious, and attended with leſs trouble and expence; the degree of fineneſs to which they are reducible being thus alſo in a manner unlimited. The conſtruction of the fanner employed for this purpoſe is different from that employed for winnowing corn; the blaſt not being collected into a ſmall compaſs as in the latter, but diffuſed over a conſiderable ſpace, leſt a violent blaſt ſhould hurry off both coarſe and fine together. For this purpoſe, the leaves of the fanner are made as long in the direction parallel to the axis as can be done conveniently. In the other direction projecting from it, they differ not from the ordinary length, nor do they in the general ſituation with reſpect to each other. Before the leaves is a wooden partition reaching half way up, to prevent the groſs powder from falling in among the leaves, which reaches about half way from bottom to top; and about two feet or leſs from this, according to the ſize of the fanner, is another partition in a ſloping direction, reaching from the bottom of the box to near the top. The whole is incloſed in a large box ſix or ſeven feet long, having in the end fartheſt off from the leaves a ſlit equal to the ſpace left betwixt the top of the box and the ſloping partition already mentioned. On the top of this is another box, extending from the farthermoſt end of the former to the hopper which holds the coarſe powder, with a hole in the end neareſt to the fanner; and upon this another

Fig. 4.

Fig. 3.

Fig. 2.

Fig. 1.

Fig. 5.

Fig. 6.

Profile.

Fig. 7.

Fig. 8.

A. Bell Print. Wal. Sculptor fecit.

Levigation. box, &c. as long as it is found that the air carries off with it any quantity of powder. This will be beſt underſtood from the following deſcription of the figure.

Plate CCLXXI. A repreſents the fanner itſelf, having a hole in the caſe for the admiſſion of the air, as uſual.

B, The firſt wooden diviſion, to prevent the return of the powder upon the leaves of the fanner.

C, The ſecond diviſion, reaching not quite to the top of the box. Its uſe is to direct the current of air produced by the fanner obliquely upwards: thus it ſtrikes the powder, falling down from the hopper, in the ſame oblique direction, and carries off the fine parts, firſt through the aperture *a*; after which ſome of them are lodged in the box D; the ſtill finer particles are carried through the aperture *b* into the ſecond box E, where part of them are lodged: they next paſs through the aperture *c* into the box F, and through *d* into the box G; the powder becoming ſtill finer and in ſmaller quantity as it aſcends into the higher boxes, until at laſt the waſte becomes ſo trifling, that the air may be allowed to paſs off entirely through the aperture *h* in the fourth or ſome other box, as is found moſt convenient.

Thus it is evident we may obtain powders of every degree of fineneſs, and ſuch as neither ſieve nor levigating mill could equal. Waſhing over with water may indeed produce powders equally fine; but the length of time requiſite for ſettling, and the trouble of drying them again, muſt decidedly give the preference to the fanner; eſpecially when we conſider, that there is not any occaſion for taking out the powder in ſmall quantities, as is the caſe in ſifting, waſhing, or levigating; but it may be allowed to remain till as much is collected in the boxes as we deſire.

The principal difficulty in the conſtruction of this fanner is the letting down the powder in a proper manner, ſo that the ſtream of air, which ought not to be very ſtrong, may freely paſs through it. For this purpoſe, the hopper muſt not let it fall in a large body, as in winnowing of corn, but in a long and thin ſheet, which can eaſily be pervaded. The beſt method ſeems to be to make the hopper extend the whole breadth of the box, having a narrow ſlit at bottom. Cloſe on the under part of this ſlit, a fluted roller ought to turn, which ſhutting up the aperture exactly, cannot allow any powder to paſs but what does ſo in conſequence of the hollow flutes of the roller; for a ſmooth round one would allow nothing to paſs. It would be proper alſo that the flutes be but ſmall, that a thin and nearly continued ſtream of powder be always deſcending; for this will contribute greatly to the fineneſs of the produce: and on this account the powder ought, before it is put into the hopper, to be paſſed through a lawn ſieve. In the figure, *e* repreſents the hopper, and *f* the fluted roller. Motion is eaſily communicated to the latter by means of a wheel faſtened on the axis of the fanner.

The coarſe powder is kept back by the partition C, and deſcends through a ſlit *i* in the bottom of the lowermoſt box, into a receptacle *k*, which may be removed occaſionally. All the joints and ſeams of the machine muſt be very cloſe, for the fine powder is very penetrating; for this reaſon alſo the hopper ought to have a lid.

LEWDNESS. See FORNICATION.—Lewdneſs is puniſhable by our law by fine, impriſonment, &c. And Mich. 15 Car. II. a perſon was indicted for open lewdneſs, in ſhowing his naked body in a balcony, and other miſdemeanors; and was fined 2000 marks, impriſoned for a week, and bound to his good behaviour for three years. 1 Sid. 168. In times paſt, when any man granted a leaſe of his houſe, it was uſual to inſert an expreſs covenant, that the tenant ſhould not entertain any lewd women, &c.

Levite || Leuſden.

LEVITE, in a general ſenſe, means all the deſcendants of Levi, among whom were the Jewiſh prieſts themſelves, who, being deſcended from Aaron, were likewiſe of the race of Levi. In a more particular ſenſe, *Levite* is uſed for an order of officers in that church, who were employed in performing the manual ſervice of the temple. They were obedient to the prieſts in their miniſtration, and brought them wood, water, and other neceſſaries for the ſacrifice.—They ſung and played upon inſtruments in the temple and in other places. They applied themſelves to the ſtudy of the law, and were the ordinary judges of the country, but always ſubordinate to the prieſts. Their ſubſiſtence was the tythes of corn, fruit, and cattle, throughout Iſrael: but the prieſts were intitled to a tenth of their tythes, by way of firſt-fruits to the Lord. Eight and forty cities were aſſigned for the reſidence of the Levites, of which the prieſts claimed thirteen, ſix whereof were choſen for cities of refuge. They were conſecrated, before they entered upon their miniſtry, by ſhaving their fleſh, waſhing their cloaths, and ſprinkling with the water of expiation. Impoſition of hands was uſed in conſecration, and two bullocks were offered at the door of the tabernacle. They waited weekly, and by turns, in the temple, beginning their attendance on one ſabbath and ending the next: During this time they were maintained out of the offerings, &c. In the time of Solomon, the number of Levites, from the age of 20 and capable of ſerving, was 38,000.

LEVITICUS, a canonical book of the Old Teſtament, ſo called from its containing the laws and regulations relating to the prieſts, Levites, and ſacrifices.

LEVITY, in phyſiology, the privation or want of weight in any body when compared with another that is heavier than it; in which ſenſe it ſtands oppoſed to gravity.

LEUK, a town of Switzerland, almoſt in the middle of the Valais; remarkable for its natural ſtrength, for the aſſembly of the ſtates that often meet there, and for its baths, whoſe water is ſo hot that they will boil eggs.

LEUNCLAVIUS (Joannes), a learned German, was deſcended from a noble family, and born at Amelbrun in Weſtphalia, 1533. He travelled through almoſt all the countries in Europe. While he was in Turkey, he collected very good materials for an "Hiſtory of the Ottoman Empire;" which he publiſhed, and alſo ſeveral other pieces concerning it, in Latin. He gave Latin tranſlations alſo of Xenophon, Zoſimus, &c. To a knowledge of the learned languages he added that of the civil law. He died at Vienna in 1593, aged 60.

LEUSDEN (John), a celebrated philologer, born in

Leutkirk || Lewes

in 1624. He ſtudied the learned languages and mathematics at Utrecht; and then went to Amſterdam, to converſe with the rabbis, and perfect himſelf in the Hebrew tongue. After which he was profeſſor of Hebrew at Utrecht, where he acquired a great reputation, and died in 1699. He wrote many valuable works; the principal of which are, 1. *Onomaſticum Sacrum*, 8vo. 2. *Clavis Hebraica & Philologica Veteris Teſtamenti*, 4to. 3. *Novi Teſtamenti Clavis Græca, cum Annotationibus Philologicis*, 8vo. 4. *Compendium Biblicum Veteris Teſtamenti*, 8vo. 5. *Compendium Græcum Novi Teſtamenti*; the beſt edition of which is that of London, in 1668, 12mo. 6. *Philologus Hebræus*, 4to. 7. *Philologus Hebræo mixtus*, 4to. 8. *Philologus Hebræo-Græcus*, 4to. 9. Notes on Jonas, Joel, Hoſea, &c. He alſo gave correct editions of ſeveral learned works.

LEUTKIRK, a free and imperial town of Germany, in Suabia, and in Algow, ſeated on a rivulet that falls into the Illar, in E. Long 10. 10. N. Lat. 47. 53.

LEUTMERITZ, a town of Bohemia, capital of a circle of the ſame name, with a biſhop's ſee, ſeated on the river Elbe, in E. Long. 14. 25. N. Lat. 50. 34.

LEWARDEN, a handſome, rich, and ſtrong town of the United Provinces, capital of Oſtergow, Weſtergow, Sevenwolden, and Weſt Frieſland. It was the uſual place of reſidence of the Stadtholder; and in buildings, as well public as private, is very magnificent. It has ſeveral canals running through the ſtreets, which are of great ſervice to their trade, eſpecially as they are continued to the ſea and to the moſt conſiderable towns of the province. E. Long. 5. 42. N. Lat. 53. 12.

LEEUWENHOEK (Anthony de), a celebrated Dutch phyſician and naturaliſt, was born at Delft in 1632, of an ancient family of that city; and acquired a very great reputation throughout all Europe, by his experiments and diſcoveries. He particularly excelled in making glaſſes for microſcopes and ſpectacles, and died in 1723. His letters to the royal ſociety of London, of which he was a member, were printed at Leyden, in 1722, in 4to.

LEVY, in law, ſignifies to gather or collect; as to levy money, and to levy a fine of lands in the paſſing a fine.

LEWENTZ, a town of Upper Hungary, in the county of Gran, and on the river of the ſame name, where the Turks were defeated in 1644. E. Long. 18. 19. N. Lat. 48. 15.

LEWES, a large well-built town of Suſſex in England, ſeated on an eminence on the banks of the river Ouſe, 50 miles from London. It is famous for a bloody battle near it, wherein King Henry III. was defeated and taken priſoner by the barons; and is ſo ancient, that we read the Saxon king Athelſtan appointed two mint-houſes here, and that in the reign of Edward the Confeſſor it had 127 burgeſſes. It is a borough by preſcription, by the ſtyle of conſtables and inhabitants. The conſtables are choſen yearly. It has handſome ſtreets and two ſuburbs, with ſix pariſh churches. It carries on a good trade; and the river Ouſe runs through it, which brings goods in boats and barges from a port 8 miles off. On this river are ſeveral iron-works, where cannon are caſt for merchant-ſhips, beſides other uſeful works. A charity-ſchool was opened here in 1711, where 20 boys are taught, clothed, and maintained, at the expence of a private gentleman, by whom they were alſo furniſhed with books; and 8 boys more are taught here at the expence of other gentlemen. Here are horſe-races almoſt every ſummer for the king's plate of L. 100. The roads here are deep and dirty; but then it is the richeſt ſoil in this part of England. The market here is on Saturday; and the fairs May 6. Whitſun-Tueſday, and October 2. The timber of this part of the county is prodigiouſly large. The trees are ſometimes drawn to Maidſtone and other places on the Medway, on a ſort of carriage called a *tug*, drawn by 22 oxen a little way, and then left there for other tugs to carry it on; ſo that a tree is ſometimes two or three years drawing to Chatham; becauſe, after the rain is once ſet in, it ſtirs no more that year, and ſometimes a whole ſummer is not dry enough to make the roads paſſable. It is cheap living here; and the town not being under the direction of a corporation, but governed by gentlemen, it is reckoned an excellent retreat for half-pay officers, who cannot ſo well confine themſelves to the rules of a corporation. It ſends two members to parliament.

Lewis.

LEWIS, one of the largeſt of the Hebrides or weſtern iſlands of Scotland, extending about 60 miles in length from north to ſouth, and from 13 to 14 in breadth, conſiſting of a great number of iſles and rocks, and parted by the ſea into two diviſions, called *Lewis* and *Harries*, the former lying to the weſtward of the other. Lewis belongs to the ſhire of Roſs; is divided by ſeveral channels, diſtinguiſhed by ſeveral names, and portioned out among different proprietors; but the *Lewis*, ſtrictly ſo called, ſtretches about 36 miles in length, from the north point of Bowling-head to the ſouthern extremity of Huſſineſs in Harries. The air is temperately cold, moiſt, and healthy; great part of the low ground is flooded with lakes; the reſt is arable in many places, and has been counted fruitful in oats, barley, rye, flax, and hemp. The ſoil in theſe parts is a light ſand, which the inhabitants manure with ſoot and ſea-ware; but great part of the iſland is covered with heath. The labouring people dig the land with ſpades, and break the clods with ſmall harrows, the foremoſt teeth of which are made of wood, and the remainder of rough heath, which ſmooths what the others have broken; and this harrow is drawn by one man, having a ſtrong trace of horſe-hair acroſs his breaſt. Of their corn they not only make malt for ale, but likewiſe a ſtrong ſpirit called *treſtareg*, which is the whiſky, or uſquebaugh, three times diſtilled. Lewis abounds with convenient bays and harbours, in which are caught, in great plenty, cod, ling, and herring: here are likewiſe whales of different ſizes, which the natives drive into the bays, and kill with harpoons. Theſe bays afford great plenty of ſhell-fiſh, ſuch as clams, oyſters, cockles, muſcles, lympits, welks, and ſuch a prodigious quantity of ſpout-fiſh is ſometimes caſt up from the ſand off Loch-tua, that they infect the air, and render it unhealthy to the neighbouring inhabitants, who are not able to conſume them, either by eating, or uſing them as manure for the ground. Some of theſe lochs and bays likewiſe produce ſmall coral and coralline. The freſh-water lakes are well ſtored with trout and eels, and the rivers yield

Lewis. yield plenty of ſalmon. Along the coaſt are found a great number of caves, which ſerve as ſhelter for the ſeals and otters, which are alſo eaten as dainties by the inhabitants; and vaſt numbers of ſea-fowl build upon the rocks and promontories.

The land-animals reared in this iſland, are cows, horſes, ſheep, goats, hogs, and deer; all theſe are of a diminutive ſize. The beef, mutton, and pork, are juicy and delicious; the horſes are active and hardy: the deer, which are of the red kind, confine themſelves to the chace of Oſervaul, about 15 miles in compaſs, which affords tolerable paſturage; but in the winter, when the ground is covered with froſt and ſnow, theſe animals are forced to feed on ſea-ware, and endure all the rigour of the ſeaſon, without any ſhelter from wood or copſe, for there is not a tree to be ſeen; nevertheleſs, the roots of very large trees, which have been cut by the ax, are found in different places. There is likewiſe a ſmall grove of birch and hazle on the ſouth-weſt ſide of Loch-Stornaway.

The inhabitants of Lewis are well-proportioned, tall, fair, ſanguine, ſtrong, and healthy. They are in general ſober, circumſpect, and hoſpitable; dexterous in ſhooting, ſwimming, and leaping; bold and ſkilful mariners; and ſo temperate, that they will tug at the oar all day, without any other proviſion than bread and water, with a ſnuſh of tobacco.

Along this coaſt we ſee ſeveral natural mounts or forts, called *Dun;* ſuch as Dun-rowly, Dun-coradel, and Dun-eiſten. There are alſo the remains of ſome old caſtles, and other monuments of antiquity. At Stornaway village we ſee the ruins of a fortreſs deſtroyed by the Engliſh garriſon ſent thither by Oliver Cromwell. To the northward of Brago there is a round tower built of large ſtones, three ſtories high, tapering towards the top, with a double wall, and a circular ſtaircaſe between, by which one may go quite round the building. On the heaths and ſummits of hills there are ſeveral cairns or heaps of ſtones, which ſerved either for graves or beacons. In the pariſh of Barvas we ſee a ſingle ſtone called the *thruſhel*, ſtanding upright, above 20 feet high, and almoſt as much in breadth. Three ſtones, about 12 feet high each, are ſeen ſtanding on the north ſide of Loch-carlvay; and many others ſtanding ſingle at great diſtances, and in remote parts of the iſland. But the moſt remarkable monument of this kind appears by the village of Claſſerniſs. Here we find 39 pyramidal ſtones ſtanding upright, about ſix or ſeven feet high from the ſurface, each about two feet in breadth. They are placed in form of an avenue, eight feet wide; the diſtance between every ſtone amounting to ſix feet, and a ſingle piece ſtands at the entrance. This avenue leads to a circle of 12 ſtones of the ſame dimenſions, with one in the centre 13 feet in length, and ſhaped like a rudder: on the eaſt, ſouth, and weſt ſides of this circle, are four ſtones, ſuch as thoſe that compoſe this round and avenue, forming three lines, or as it were rays from the body of the circle. This is ſuppoſed to have been a Druid temple; and tradition reports, that the chief Druid ſtood by the large ſtone in the centre, and harangued the audience. At the diſtance of a quarter of a mile there is another circle of the ſame nature; but without the range and avenue

In all probability, theſe, as well as the monuments we have deſcribed in our account of the Orkneys, and Stone-henge on Saliſbury-plain, were places of worſhip erected by the Druids in time of Pagan ſuperſtition. The chief town in Lewis is called STORNAWAY. Lewis.

There is a conſiderable number of inferior adjacent iſles and rocks, ſome of which hardly deſerve to be mentioned; ſuch as the ſmall iſland Garve at the mouth of Loch Carlvay, Berinſay, Fladda, Bernera Minor, and Bernera Major, Kialiſy, Cavay, Carvay, Grenim, Pabay, Shirem, Vexay, Wuya the Larger and Leſſer, and the Flannan iſlands, which the ſeamen denominate the *northern hunters*. Theſe are viſited every ſummer by the inhabitants of the Lewis, who go thither in queſt of fowls, eggs, down, quills, and feathers, as well as to ſhear or kill the ſheep that are kept here for paſture. As theſe iſlands are very ſteep and rocky, the viſitors, after having landed and climbed up the rock by a ladder, uncover their heads, and, making a turn ſun-ways, thank God for having eſcaped the danger they have undergone. In the largeſt iſland are the ruins of a chapel dedicated to St Flannan, from whom the iſles derive their name. Thither the fowlers repairing, ſtrip themſelves of their upper garments, which being laid upon a ſtone, they advance towards the altar, and repeat three prayers; an exerciſe which is performed every morning and evening. They obſerve many other ſuperſtitious cuſtoms during their reſidence on theſe rocks; and when they have landed their boat with their purchaſe, return to the larger iſlands. Among the iſlands belonging to the Lewis, we may likewiſe take notice of the ſmall iſle of Pigmies, ſo called, becauſe bones reſembling thoſe of human creatures, but of very ſmall dimenſions, have been dug out of the ground.

The iſland of Lewis is divided into the two pariſhes of Barvas and Eye, and in each of theſe one miniſter is ſettled; but there is a great number of churches and chapels dedicated to different ſaints, in the different iſles which compoſe this cluſter. All theſe were ſanctuaries before the reformation, but now they are diveſted of that privilege. The people of theſe iſlands are Preſbyterians, with a few Proteſtants of the Engliſh communion, and a ſtill ſmaller number of Roman Catholics. The Proteſtants obſerve the feſtivals of Chriſtmas, Good Friday, Eaſter, and Michaelmas; on the laſt of which the individuals of both ſexes perform an anniverſary cavalcade.

LEWIS, or LOUIS, the name of ſeveral kings of France. See ERANCE.

LEWIS VII. anno 1137, was the firſt who had the courage to oppoſe the encroachments of the popes on the regal authority: Pope Innocent II. excommunicated him for appointing an archbiſhop of Bourges; but Lewis defended his prerogatives, and put the prieſts to death who had been the authors of the quarrel. In 1147, he put himſelf at the head of an army of 80,000 men, and marched againſt the Saracens, in the ſecond cruſade, but was defeated; and returning into France by ſea, was taken by the Greeks, but reſcued by Roger king of Sicily. His queen Eleonora accompanied him in this expedition; and being ſuſpected of infidelity with Saladin, a young Turk,

Lewis

Lewis. Lewis divorced her, and ſhe was married ſix weeks after to Henry duke of Normandy, (Henry II. king of England). Lewis died in 1180, aged 60.

Lewis IX. anno 1226 (canonized), was one of the greateſt monarchs of France; equally memorable for his valour and his virtues, but unfortunately miſled by the ſuperſtition of the times: he ſacrificed his own repoſe, and the welfare of his kingdom, to the folly of cruſading. In 1248, leaving France to the care of his mother, he embarked for Egypt, attended by his queen, his three brothers, and the flower of the French nobility. At firſt his victories were rapid: he took Damietta in 1249; but the following year he was defeated and taken priſoner by the Turks, with all the nobility in his train, and the greateſt part of his army. The ſultan ſent to him in priſon, to demand an exorbitant ſum for his ranſom; and his anſwer being truly noble, deſerves to be recorded: "Tell the ſultan, that a king of France is not to be ranſomed with money; I will give the ſum required for my people, and Damietta for myſelf." Theſe terms were accepted, and a peace of ten years enſued. Upon his return to France, he diminiſhed the taxes, revoked thoſe which the cupidity of the financiers had introduced; iſſued ſeveral ſalutary edicts; founded ſeveral churches and hoſpitals; and effectually overturned the eccleſiaſtical juriſdiction of the court of Rome, by his pragmatic ſanction in 1269, which eſtabliſhed the independency of the Gallican church. Thirteen years reſidence in his capital indemnified his ſubjects for his abſence; but his pious zeal prevented the enjoyment of this happineſs: he embarked for the ſixth cruſade in 1270; and died the ſame year, at the ſiege of Tunis, aged 55.

Lewis XI. anno 1461. His oppreſſions obliged his ſubjects to enter into a league againſt him, ſtyled "*Ligue de bien publiq*," in which his brother the duke of Berri and ſome of the principal nobility were concerned: they ſolicited ſuccours from John duke of Calabria, who joined them with 500 Swiſs (the firſt introduction of Swiſs ſoldiers into the French armies.) His reign was almoſt one continued ſcene of civil war; and it is computed that 4000 of his ſubjects were executed in public and privately, either for being in arms againſt him, or ſuſpected by him. In his laſt illneſs, he drank the warm blood of children, in the vain hope of reſtoring his decayed ſtrength. He died in 1483, aged 60. The poſts for letters were eſtabliſhed in his reign, owing to his eagerneſs for news; the firſt inſtitution of this nature in Europe.

Lewis XII. anno 1492, ſtyled *the Juſt*, and *the Father of his people;* memorable for his valour in the field, and his wiſdom in the cabinet. A great general; but unfortunate towards the end of his reign, when he did not command his troops in perſon: his orders tranſmitted from home were miſunderſtood, or wilfully diſobeyed; and he had the mortification, before he died, to ſee the total expulſion of the French from the poſſeſſions he had acquired for them by his perſonal bravery. At 53 years of age, he married the princeſs Mary of England, ſiſter of Henry VIII. and being of a delicate conſtitution, fell a victim (according to the French hiſtorians) to amorous dalliance; for he died in about two months after his nuptials, in 1515.

Lewis XIII. anno 1610, increaſed the military reputation of his country, and made conſiderable additions to its domains. The beginning of his reign was occupied in civil wars with his mother and his Proteſtant ſubjects; in which he was excited to continue by his famous miniſter cardinal Richelieu, who attended him to the ſiege of Rochelle, the bulwark of the Huguenot party. This place was reduced by famine to ſurrender, in 1628, after a ſiege of more than a year. Upon this and other occaſions, the king gave proofs of great perſonal bravery. His attachment to his ally the duke de Nevers, who ſucceeded to the duchy of Mantua, but was refuſed the inveſtiture by Charles VI. emperor of Germany, involved him in a war with that prince, the Spaniards, and the duke of Savoy; in which Lewis was victorious; and obtained a treaty of peace, by which the duke of Mantua was guarantied in the poſſeſſion of his dominions. In 1635, a new war broke out between France and Spain, and the emperor took part with the latter: it laſted 13 years againſt the emperor, and 25 againſt Spain, with various ſucceſs; and the different armies kept on foot, in the Low Countries, on the frontiers of France, and in Italy, in the firſt years of this war, paved the way for the ſignal ſucceſſes of Lewis XIV. the campaigns of theſe armies being a military ſchool of diſcipline and experience for the French officers, beſides giving them a knowledge of the countries which became the ſeat of war in the next reign. Lewis XIII. died 1643, aged 41.

Lewis XIV. *le Grand* (king at five years of age), anno 1643. He was at firſt ſtyled *Dieu-donne*, becauſe the French conſidered him as the gift of heaven, granted to their prayers after the queen had been barren 22 years. This princeſs (Anne of Auſtria) was declared regent by Lewis XIII. and ſaw herſelf under a neceſſity to continue the war againſt Philip IV. king of Spain, her brother. The duke d'Enguin was made general of the French armies; and ſo ſignal was the ſucceſs of this renowned warrior (afterwards prince of Condé, and known by the ſtyle of *the Great Condé*), that his victories brought on the advantageous treaties of Munſter in 1648, between France, the emperor Ferdinand III. and Chriſtina queen of Sweden: the baſis of the aggrandiſement of France in this reign; the principal events of which, and of the next, are related under the articles Britain, *United* Provinces, &c. Lewis XIV. died in 1715, aged 77.

Lewis XV. (his great-grandſon) ſucceeded in 1715. He was ſtyled, in the courſe of his reign, *the well beloved*, which he loſt ſome years before he died; and was deteſted and deſpiſed by his ſubjects for his ſhameful attachment to a young girl, under the title of his *miſtreſs*, who, by the miniſtry of her patron the duke d'Aiguillon, governed the kingdom, and invaded the ancient rights and privileges of the people. He died in 1774, in the 64th year of his age and 59th of his reign.

LEXINGTON, a town of North America, and capital of Kentucky. It ſtands on the head waters of Elkhorn river, is reckoned the capital of Kentucky. Here the courts are held, and buſineſs regularly conducted. In 1786, it contained about 109 houſes and ſeveral ſtores, with a good aſſortment of dry goods. It muſt have greatly increaſed ſince.

LEX, Law. See Law.—The Roman laws were

Lex.

of three kinds: 1ſt, Such as were made by their kings. 2d, The laws of the twelve tables brought by the *Decemviri* from Athens, &c. And, 3d, Such as were propoſed by the ſuperior magiſtrates in the times of the republic. The laws of this laſt claſs were enacted in the following manner.

No law could be propoſed but by ſome of the following magiſtrates, viz. the *Prætor*, the *Conſuls*, the *Dictator*, the *Interrex*, the *Decemviri*, the *Military Tribunes*, *Triumviri*, and *Tribunes* of the people. If any of theſe propoſed a law, it was firſt committed to writing, and privately examined as to its utility and probable conſequences, by ſome perſons well qualified for the taſk; ſometimes it was referred to the whole ſenate for their ſentiments. It was then hung up publicly for three market-days, that all the people might have time to examine it, and conſider its tendency: This was called *legis promulgatio*, *quaſi provulgatio*. If the perſon who framed the bill did not ſee cauſe in the mean time to drop it, the people were convened in *comitia*, and he addreſſed them in an oration, being alſo ſeconded by his friends, ſetting forth the expediency and probable utility of ſuch a law: This was called *rogatio legis*, becauſe the addreſs was always prefaced with this petitionary form of words, *Velitis jubeatiſne, Quirites?* "Will you, O Romans, conſent and order this law to paſs?" This being done, thoſe that diſliked the motion delivered their ſentiments in oppoſition to it. An urn was then brought to certain prieſts who attended upon the occaſion, into which were caſt the names of the tribes, centuries, or *curia*, as the *comitia* happened to be *tributa*, *centuriata*, or *curiata*. The names were ſhaken together; and the firſt drawn tribe or century was called *prærogativa*, becauſe their ſuffrages were firſt taken. The *curia* that was firſt drawn was called *principium* for the ſame reaſon. The other tribes, centuries, &c. were called *tribus jure vocatæ*, *centuriæ jure vocatæ*, &c.

Matters being in this ſituation, the *veto* or negative voice of the tribunes of the people might put an entire end to the proceedings, and diſſolve the aſſembly. The tribune's interference was called *interceſſio*. The conſul alſo had it in his power to ſtop further proceedings, by commanding any of the holidays called *feriæ imperativæ* to be obſerved. The *comitia* would of courſe be diſſolved alſo by any of the perſons preſent being ſeized with the falling-ſickneſs, or upon the appearance of any unlucky omen. But ſuppoſing the buſineſs to meet with no interruption of this ſort, the people were each of them preſented with two tablets, on one of which was written in large characters A. on the other U. R. Their diſapprobation of the bill was expreſſed by throwing into an urn the tablet inſcribed A. ſignifying "I forbid it;" *antiquo*, "I prefer the old." Their aſſent was ſignified by throwing in the tablet marked U. R. i. e. *uti rogas*, "be it as you deſire." According to the majority of theſe tablets the law paſſed or not. If it paſſed, it was written upon record, and carried into the treaſury; this was called *legem ferre*. Afterwards it was engraved upon plates of braſs, and hung up in the moſt public and conſpicuous places: this was termed *legem figere*, and a future repeal of this law was *legem refigere*.

If a law paſſed in the *comitia curiata*, it was called *lex curiata*; if in the *comitia centuriata*, it had the name of *lex centuriata*; but if it paſſed in the *comitia tributa*, it was termed *plebiſcitum*. The laws, too, generally bore the names of the propoſers, as *lex Ælia*, *lex Fuſia*, &c.

Romulus uſed to make laws by his own ſingle authority, but ſucceeding kings ſought the approbation of the people.

Lexiarchi

LEXIARCHI, at Athens, ſix officers aſſiſted by 30 inferior ones, whoſe buſineſs it was to lay fines upon ſuch as came not to the public aſſemblies, and alſo to make ſcrutiny among ſuch as were preſent.

The lexiarchi kept a regiſter of the age, manners, and abilities of all the citizens, who were always inrolled at the age of 20.

LEXICON, the ſame with dictionary. The word is chiefly uſed in ſpeaking of Greek dictionaries: it is derived from the Greek λεξις, *word*, *diction*; of λεγω *I ſpeak*.

Leyden.

LEYDEN, in Latin *Lugdunum Batavorum*, one of the largeſt and fineſt cities in Holland, abounds with canals, along which are rows of lofty trees that afford very pleaſant walks. An arm or ſmall branch of the Rhine runs through it. Over the canals are 145 bridges, moſt of them of ſtone or brick. The univerſity here is the oldeſt in the United Provinces: it has large privileges; a library well furniſhed, and particularly rich in manuſcripts; a phyſic-garden well ſtocked with all ſorts of plants, many of which have been brought from the Cape of Good Hope and the Eaſt Indies; an anatomy-hall, well provided with ſkeletons; and an obſervatory. The profeſſors, who are generally very eminent, read public lectures four times a week, for which they take no money, but about three guineas are paid for a courſe of private lectures, which laſts a whole year. The ſtudents have no diſtinct habit, but all wear ſwords, though they generally go to the public and private lectures in their night-gowns and ſlippers. The ſalaries of the profeſſors are from 100 l. to 200 l. a-year: they wear gowns only when they preſide at public diſputations, read public lectures, or meet in the ſenate; and their lectures are always in Latin. The ſtudents do not lodge in the univerſity, but where they pleaſe in the town. The cloth manufacture here is much decayed, which formerly flouriſhed to ſuch a degree, that 100,000 pieces, it is ſaid, have ſometimes been made in a year. The city is famous for the long and ſevere ſiege it maintained in 1573 againſt the Spaniards. We cannot help mentioning the reply of that illuſtrious magiſtrate, Adrian de Verf, when the citizens repreſented to him the havoc made by the famine during the ſiege, and inſiſted upon his ſurrendering: "Friends (ſaid he), here is my body, divide it among you to ſatisfy your hunger, but baniſh all thoughts of ſurrendering to the cruel and perfidious Spaniard." They took his advice, in regard to their not ſurrendering, and never would liſten to any overtures; but told the Spaniards, they would hold out as long as they had one arm to eat and another to fight. There are ſome fine churches here, and many long, broad, handſome, ſtreets; but the Papiſts, as at Haerlem, are more numerous than the Proteſtants.

Leyden Phial, a phial coated on the inſide and outſide with tinfoil, or other proper conducting ſubſtance,

Leyſera || Lhuyd.

and furniſhed with a braſs wire and knob, for giving the electrical ſhock. See ELECTRICITY-*Index*.

Lucas van LEYDEN. See LUCAS.

LEYSERA, in botany: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ*. The receptacle is naked; the pappus paleaceous; that of the diſc plumy; the calyx ſcarious.

LEYTE, one of the Philippine iſlands in the Eaſt Indies, ſituated in E. Long. 118. 0. N. Lat. 11. 0. Its greateſt length is about 40 leagues, and its circumference about 90 or 100. Its ſoil on the eaſt ſide is very fruitful; but there are very high mountains which cut it almoſt through the middle, and occaſion ſo great an alteration in the air, that when it is winter on the north ſide, it is ſummer on the ſouthern part of the iſland. Thus when the inhabitants of one half of the iſland reap, the others ſow; and they have two plentiful harveſts in a year, to which the rivers running down from the abovementioned mountains contribute not a little. The iſland contains about 9000 inhabitants, who pay tribute to the Spaniards in rice, wax, and quilts.

LHUYD, or LHOYD (Humphrey), a learned antiquarian of the 16th century, born at Denbigh, who applied himſelf to the ſtudy of phyſic; and living moſtly within the walls of Denbigh caſtle, practiſed there as a phyſician; and died in 1570, with the character of a well-bred gentleman. He wrote and tranſlated ſeveral pieces relative to hiſtory and antiquities; in particular, The hiſtory of Cambria, now called *Wales*, from Caradoc of Langcarvan, &c. but died before it was finiſhed: however, Sir Henry Sidney, lord preſident of Wales, employed Dr David Powel to finiſh it, who publiſhed it in 1584. A new and improved edition of this work was publiſhed in 1774.

LHUYD (Edward), keeper of the Muſeum at Oxford, was a native of South Wales, the ſon of Charles Lhuyd, Eſq; of Lhanvorde. He was educated at Jeſus College, Oxford, where he was created M. A. July 21. 1701. He was bred under Dr Plot, whom he ſucceeded as keeper of the Aſhmolean muſeum, and had the uſe of all Vaughan's collections. With inceſſant labour and great exactneſs he employed a conſiderable part of his life in ſearching into the Welſh antiquities; had peruſed or collected a great deal of ancient and valuable matter from their MSS.; tranſcribed all the old charters of their monaſteries that he could meet with; travelled ſeveral times over Wales, Cornwall, Scotland, Ireland, Armoric Bretagne, countries inhabited by the ſame people, compared their antiquities, and made obſervations on the whole; but died in July 1709, before he had digeſted them into the form of a diſcourſe, as he intended, on the ancient inhabitants of this iſland. The untimely death of this excellent antiquary prevented the completing of many admirable deſigns. For want of proper encouragement, he did very little towards underſtanding the Britiſh bards, having ſeen but one of thoſe of the ſixth century, and not being able to procure acceſs to two of the principal libraries in the country. He communicated many obſervations to Biſhop Gibſon, whoſe edition of the *Britannia* he reviſed; and publiſhed "*Archæologia Britannica*, giving ſome account additional to what has been hitherto publiſhed of the languages, hiſtories, and cuſtoms of the original inhabitants of Great Britain, from collections and obſervations in travels through Wales, Cornwall, Bas Bretagne, Ireland, and Scotland, Vol. I. Gloſſography, Oxford 1707," fol. He left in MS. a Scottiſh or Iriſh-Engliſh Dictionary, propoſed to be publiſhed in 1732 by ſubſcription, by Mr David Malcolme, a miniſter of the church of Scotland, with additions; as alſo the Elements of the ſaid language; with neceſſary and uſeful informations for propagating more effectually the Engliſh language, and for promoting the knowlege of the ancient Scottiſh or Iriſh, and very many branches of uſeful and curious learning. Lhuyd, at the end of his preface to the Archæologia, promiſes an hiſtorical dictionary of Britiſh perſons and places mentioned in ancient records. It ſeems to have been ready for preſs, though he could not ſet the time of publication. His collections for a ſecond volume, which was to give an account of the antiquities, monuments, &c. in the principality of Wales, were numerous and well choſen; but, on account of a quarrel between him and Dr Wynne, then fellow, afterwards principal of the college, and biſhop of St Aſaph, he refuſed to buy them, and they were purchaſed by Sir Thomas Seabright, of Beachwood in Hertfordſhire, in whoſe library the greateſt part ſtill remain, but ſo indigeſted, and written with ſo many abbreviations, that nobody can undertake to publiſh them. They conſiſt of about 40 volumes in folio, 10 in quarto, and above 100 ſmaller, and all relate to Iriſh or Welſh antiquities, and chiefly in thoſe languages. Carte made extracts from them about or before 1736; but theſe were chiefly hiſtorical. Sir John Seabright has given Mr Pennant 23 of Lhuyd's MSS. Latin and Engliſh. Many of his letters to Liſter, and other learned contemporaries, were given by Dr Fothergill to the univerſity of Oxford, and are now in the Aſhmolean muſeum. Lhuyd undertook more for illuſtrating this part of the kingdom than any one man beſides ever did, or than any one man can be equal to.

Lhuyd || Libanus.

LIBANIUS, a famous Greek rhetorician and ſophiſt in the 4th century, was born at Antioch, and had a great ſhare in the friendſhip of Julian the Apoſtate. That prince offered him the dignity of *Præfectus Prætorio*; but Libanius refuſed it, thinking the name of *ſophiſt*, or *profeſſor of eloquence*, much more honourable. There are ſtill extant ſeveral of his letters and Greek orations, by which he acquired great reputation; but his ſtyle is ſomewhat affected and obſcure. He was a pagan. Baſil and Chryſoſtom were his diſciples about the year 360. His letters were publiſhed at Amſterdam in 1738; his orations at Venice, 1755.

LIBANOMANTIA, in antiquity, a ſpecies of divination performed with frankincenſe; which, if it preſently caught fire, and ſent forth a grateful odour, was eſteemed a happy omen, and *vice verſa*.

LIBANUS, the name of a chain of mountains of Turkey in Aſia, which lie between Proper Syria and Paleſtine, extending, from weſt to eaſt, from the Mediterranean ſea as far as Arabia. The ſummits of theſe mountains are ſo high, that they are always covered with ſnow; but below are very pleaſant, and fruitful

Libation ‖ Libel.

fruitful valleys. They were formerly famous for the great number of cedar-trees growing thereon; but now there are very few remaining. Geographers diſtinguiſh this chain into Libanus and Antilibanus; the latter of which lies on the ſouth ſide of the valley, riſing near the ruins of Sidon, and terminates at others in Arabia, in N. Lat. 34. They are ſeparated from each other at an equal diſtance throughout; and form a baſon, or country, called by the ancients *Cælo Syria*.

LIBATION, amongſt the Greeks and Romans, was an eſſential part of ſolemn ſacrifices. It was alſo performed alone, as a drink offering, by way of procuring the protection and favour of the gods, in the ordinary affairs of life. Libations, according to the different natures of the gods in honour of whom they were made, conſiſted of different liquids, but wine was the moſt uſual. The wine offered to the gods was always unmixed with water. We meet with libations of water, libations of honey, libations of milk, and libations of oil; theſe are called σπονδαι ἀκρατοι. The libation was made with a ſerious deportment and ſolemn prayer. At ſacrifices, the libation, after it had been taſted by the prieſt, and handed to the byſtanders, was poured upon the victim. At entertainments, a little wine was generally poured out of the cup, before the liquor began to circulate, to ſhow their gratitude to the gods for the bleſſings they enjoyed.

Libations were alſo in uſe among the Hebrews, who poured an hin of wine on the victim after it was killed, and the ſeveral pieces of the ſacrifice were laid on the altar, ready to be conſumed in the flames.

LIBAW, a ſea-port town of Courland, lying on the Baltic ſea, conſiſting entirely of wooden houſes. It belongs to the duke of Courland, and is ſituated in E. Long. 21. 27. N. Lat. 56. 27.

LIBEL, *(libellus famoſus)*, taken in its largeſt and moſt extenſive ſenſe, ſignifies any writing, picture, or the like, of an immoral or illegal tendency; but, in a peculiar ſenſe, is uſed to denote a malicious defamation of any perſon, and eſpecially a magiſtrate, made public by either printing, writing, ſigns or pictures, in order to provoke him to wrath, or expoſe him to public hatred, contempt, and ridicule. The direct tendency of theſe libels is the breach of the public peace, by ſtirring up the objects of them to revenge, and perhaps to bloodſhed. The communication of a libel to any one perſon is a publication in the eye of the law: and therefore the ſending an abuſive private letter to a man is as much a libel as if it were openly printed, for it equally tends to a breach of the peace.

With regard to libels in general, there are, as in many other caſes, two remedies; one by indictment, and another by action. The former for the *public* offence; for every libel has a tendency to break the peace, or provoke others to break it: which offence is the ſame whether the matter contained be true or falſe; and therefore the defendant, on an indictment for publiſhing a libel, is not allowed to allege the truth of it by way of juſtification. But in the remedy by action on the caſe, which is to repair the party in damages for the injury done him, the defendant may, as for words ſpoken, juſtify the truth of the facts, and ſhow that the plaintiff has received no injury at all. What was ſaid with regard to words ſpoken, will alſo hold in every particular with regard to libels by writing or printing, and the civil actions conſequent thereupon: but as to ſigns or pictures, it ſeems neceſſary always to ſhow, by proper innuendos and averments of the defendant's meaning, the import and application of the ſcandal, and that ſome ſpecial damage has followed; otherwiſe it cannot appear, that ſuch libel by picture was underſtood to be levelled at the plaintiff, or that it was attended with any actionable conſequences. Libella.

In a civil action, then, a libel muſt appear to be falſe, as well as ſcandalous; for, if the charge be true, the plaintiff has received no private injury, and has no ground to demand a compenſation for himſelf, whatever offence it may be againſt the public peace: and therefore, upon a civil action, the truth of the accuſation may be pleaded in bar of the ſuit. But, in a criminal proſecution, the tendency which all libels have to create animoſities, and to diſturb the public peace, is the ſole conſideration of the law. And therefore, in ſuch proſecutions, the only points to be conſidered are, firſt, the making or publiſhing of the book or writing; and, ſecondly, whether the matter be criminal: and, if both theſe points are againſt the defendant, the offence againſt the public is complete. The puniſhment of ſuch libellers, for either making, repeating, printing, or publiſhing the libel, is a fine, and ſuch corporal puniſhment as the court in its diſcretion ſhall inflict; regarding the quantity of the offence, and the quality of the offender. By the law of the twelve tables at Rome, libels, which affected the reputation of another, were made a capital offence: but, before the reign of Auguſtus, the puniſhment became corporal only. Under the emperor Valentinian it was again made capital, not only to write, but to publiſh, or even to omit deſtroying them. Our law, in this and many other reſpects, correſponds rather with the middle age of Roman juriſprudence, when liberty, learning, and humanity, were in their full vigour, than with the cruel edicts that were eſtabliſhed in the dark and tyrannical ages of the ancient decemviri, or the latter emperors.

In this, and other inſtances, where blaſphemous, immoral, treaſonable, ſchiſmatical, ſeditious, or ſcandalous libels are puniſhed by the Engliſh law, ſome with a greater, others with a leſs degree of ſeverity; the *liberty of the preſs*, properly underſtood, is by no means infringed or violated. See *Liberty of the Preſs*.

LIBELLA, a piece of money amongſt the Romans, being the tenth part of the denarius, and equal in value to the as. It was called *libella*, as being a little pound, becauſe equal to a pound of braſs.—Its value in our money is 1 ob. 1 qu. or a half-penny farthing. See Money.

Libella, or *Libellula*, in zoology, a genus of four-winged flies, called in Engliſh *dragon flies*, or *adder flies*; the characters of which are theſe: The mouth is furniſhed with jaws: the feelers are ſhorter than the breaſt; and the tail of the male terminates in a kind of hooked forceps. There are 21 ſpecies, chiefly diſtinguiſhed by their colour. They have all two very large and reticulated eyes, covering the whole ſurface of the head. They fly very ſwiftly; and prey upon the wing, clearing the air of innumer- Plate CCLXXIV.

Libelli, Liber.

able little flies. They are found in Auguſt and September in our fields and gardens, eſpecially near places where there are waters, as they have their origin from worms living in that element. The great ones uſually live all their time about waters; but the ſmaller are common among hedges, and the ſmalleſt of all frequent gardens. The ſmaller kind often ſettle upon buſhes, or upon the ground; but the large ones are almoſt always upon the wing, ſo that it is very difficult to take them. Their eyes are beautiful objects for the microſcope. The largeſt ſpecies is produced from a water-worm that has ſix feet, which, yet young and very ſmall, is transformed into a chryſalis, that has its dwelling in the water. People have thought they diſcovered them to have gills like fiſhes. It wears a maſk as perfectly formed as thoſe that are worn at a maſquerade; and this maſk, faſtened to the inſect's neck, and which it moves at will, ſerves it to hold its prey while it devours it. The period of transformation being come, the chryſalis makes to the water-ſide, undertakes a voyage in ſearch of a convenient place; fixes on a plant, or ſticks faſt to a bit of dry wood. Its ſkin, grown parched, ſplits at the upper part of the thorax. The winged inſect iſſues forth gradually, throws off its ſlough, expands its wings, flutters, and then flies off with gracefulneſs and eaſe. The elegance of its ſlender ſhape, the richneſs of its colours, the delicacy and reſplendent texture of its wings, afford infinite delight to the beholder. The ſexual parts of the libellulæ are differently ſituated in the male and female. It is under the body at the joining of the thorax, that thoſe parts are diſcovered in the males: thoſe of the females are known by a ſlit placed at the extremity of the body. Their amours conclude in a rape. The male, while hovering about, watches, and then ſeizes the female by the head with the pincers with which the extremity of his tail is armed. The raviſher travels thus through the air, till the female yielding to ſuperior ſtrength, or rather to inclination, forms her body into a circle that terminates at the genitals of the male, in order to accompliſh the purpoſe of nature. Theſe kind of rapes are common. Libellulæ are ſeen thus coupled in the air, exhibiting the form of a ring. The female depoſits her eggs in the water, from whence ſpring water-worms, which afterwards undergo the ſame transformations.

Barbut's Inſects.

LIBELLI, was the name given to the bills which were put up amongſt the Romans, giving notice of the time when a ſhow of gladiators would be exhibited, with the number of combatants, and other circumſtances. This was called *munus pronunciare* or *proponere*.—Theſe bills were ſometimes termed *edicta*. Theſe public notices were given by the perſon who deſigned to oblige the people with the ſhow, and were frequently attended with pictures repreſenting the engagement of ſome celebrated gladiators. This cuſtom is alluded to by Horace, lib. ii. ſat. vii. v. 96, &c.

There was alſo the *famoſus libellus*, a defamatory libel. Seneca calls them *contumelioſi libelli*, infamous rhymes, which by a Roman ordinance were puniſhable with death. Libellus alſo in the civil law ſignifies the declaration, or ſtate of the proſecutor' charge againſt the defendant; and it has the like ſignification in our ſpiritual courts.

LIBER, in vegetables, the bark or rind, principally of trees. This is to be conceived as conſiſting of a number of cylindric and concentric ſurfaces whoſe texture is reticular, and in ſome trees plainly extruſible every way, by reaſon that the fibres are ſoft and flexible. While in this condition, they are either hollow regular canals, or, if not ſo, they have interſtitial ſpaces which ſerve the office of canals. The nutritious juice which they are continually receiving, remains in part in them, makes them grow in length and thickneſs, and ſtrengthens and brings them cloſer together; and by this means the texture which was before reticular becomes an aſſemblage of ſtraight fibres ranged vertically and parallel to each other; that is, as they are thus altered behind one another, they by degrees become a new ſubſtance, more woody, called *blea*.

Libera || Libertines.

LIBERA, in mythology, the name of a goddeſs, which Cicero, in his book Of the Gods, repreſents as the daughter of Jupiter and Ceres. Ovid in his Faſti ſays that the name was given by Bacchus to Ariadne.

Libera is exhibited on medals as a kind of female Bacchus, crowned with vine leaves.

LIBERAL ARTS, are ſuch as depend more on the labour of the mind than on that of the hands; or, that conſiſt more in ſpeculation than operation; and have a greater regard to amuſement and curioſity than to neceſſity.

The word comes from the Latin *liberalis*, which among the Romans ſignified a perſon who was not a ſlave; and whoſe will, of conſequence, was not checked by the command of any maſter.

Such are grammar, rhetoric, painting, ſculpture, architecture, muſic, &c. The liberal arts uſed formerly to be ſummed up in the following Latin verſe: *Lingua, Tropus, Ratio, Numerus, Tonus, Angulus, Aſtra.* And the mechanical arts, which, however, are innumerable, under this:

Rus, Nemus, Arma, Faber, Vulnera, Lana, Rates.

See ARTS.

LIBERALIA, feaſts celebrated by the ancient Romans, in honour of Liber or Bacchus, the ſame with thoſe which the Greeks called DIONYSIA, and *Dionyſiaca*

They took their name from *liber*, i. e. *free*, a title conferred on Bacchus in memory of the liberty or freedom which he granted to the people of Bœotia; or, perhaps, becauſe wine, whereof he was the reputed diety, delivers men from care, and ſets their mind at eaſe and freedom. Varro derives the name of this feaſt from *liber*, conſidered as a noun adjective, and ſignifying *free*; becauſe the prieſts were free from their function, and eaſed of all care, during the time of the liberalia: as the old women officiated in the ceremonies and ſacrifices of theſe feaſts.

LIBERIA, in Roman antiquity, a feſtival obſerved on the 16th of the kalends of April, at which time the youth laid aſide their juvenile habit for the toga virilis, or habit peculiar to grown men. See the article TOGA.

LIBERTINES, LIBERTINI, in eccleſiaſtical hiſtory, a religious ſect, which aroſe in the year 1525, whoſe principal tenets were, that the Deity was the ſole operating cauſe in the mind of man, and the immediate author of all human actions; that, conſequently, the diſtinctions of good and evil, which had been eſtabliſhed with regard to thoſe actions, were falſe and groundleſs,

and

Libertines, Libertus.

and that men could not, properly ſpeaking, commit ſin; that religion conſiſted in the union of the ſpirit or rational ſoul with the Supreme Being; that all thoſe who had attained this happy union, by ſublime contemplation and elevation of mind, were then allowed to indulge, without exception or reſtraint, their appetites or paſſions; that all their actions and purſuits were then perfectly innocent; and that, after the death of the body, they were to be united to the Deity. They likewiſe ſaid that Jeſus Chriſt was nothing but a mere *je ne ſçai quoi*, compoſed of the ſpirit of God, and of the opinion of men.

Theſe maxims occaſioned their being called *Libertines*; and the word has been uſed in an ill ſenſe ever ſince.

The *Libertini* ſpread principally in Holland and Brabant. Their leaders were one Quintin, a Picard, Pockeſius, Ruffus, and another called Chopin, who joined with Quintin, and became his diſciple.

This ſect obtained a certain footing in France thro' the favour and protection of Margaret, queen of Navarre, and ſiſter to Francis I. and found patrons in ſeveral of the reformed churches. This ſect was probably a remnant of the more ancient Beguards or Brethren of the Free Spirit.

Libertines of Geneva, were a cabal of rakes rather than of fanatics; for they made no pretences to any religious ſyſtem, but pleaded only for the liberty of leading voluptuous and immoral lives. This cabal was compoſed of a certain number of licentious citizens, who could not bear the ſevere diſcipline of Calvin, who puniſhed with rigour not only diſſolute manners, but alſo whatever bore the aſpect of irreligion and impiety. In this turbulent cabal there were ſeveral perſons who were not only notorious for their diſſolute and ſcandalous manner of living, but alſo for their atheiſtical impiety, and contempt of all religion. To this odious claſs belonged one Gruet, who denied the divinity of the Chriſtian religion, the immortality of the ſoul, the difference between moral good and evil, and rejected with diſdain the doctrines that are held moſt ſacred among Chriſtians; for which impieties he was at laſt brought before the civil tribunal, in the year 1550, and condemned to death. The Genevan ſpirit of reformation, improperly directed by the violence and zeal of Calvin, did at this time operate to a degree which has marked the character of this great reformer with reproach. For in 1544, Sebaſtian Caſtalio, maſter of the public ſchool at Geneva, who was a man of probity, and diſtinguiſhed by his learning and taſte, was, nevertheleſs, depoſed from his office and baniſhed the city, becauſe he diſapproved ſome of the meaſures that were purſued and ſome of the opinions entertained by Calvin and his colleagues, and particularly that of abſolute and unconditional predeſtination. Jerome Bolſec alſo, a man of genius and learning, who became a convert to the Proteſtant religion and fled to Geneva for protection, was caſt into priſon, and ſoon after ſent into baniſhment, becauſe, in 1551, he imprudently and indecently declaimed, in full congregation and at the cloſe of public worſhip, againſt the doctrine of abſolute decrees.

LIBERTUS, or LIBERTINUS, among the Romans, a freedman, or a perſon ſet free from a legal ſervitude.

Theſe ſtill retained ſome mark of their ancient ſtate: he who made a ſlave free having a right of patronage over the *libertus*; ſo that if the latter failed of ſhowing due reſpect to his patron, he was reſtored to his ſervitude; and if the *libertus* died without children, his patron was his heir. See SLAVE.

Liberty.

In the beginning of the republic, *libertinus* denoted the ſon of a *libertus* or freedman; but afterwards, before the time of Cicero, and under the emperors, the terms *libertus* and *libertinus*, as Suetonius has remarked, were uſed as ſynonymous.

LIBERTY, denotes a ſtate of freedom, in contradiſtinction to *ſlavery* or *reſtraint*; and may be conſidered as either *natural* or *civil*.

The abſolute rights of man, conſidered as a free agent, endowed with diſcernment to know good from evil, and with power of chooſing thoſe meaſures which appear to him to be moſt deſirable, are uſually ſummed up in one general appellation, and denominated the *natural liberty of mankind*. This natural liberty conſiſts properly in a power of acting as one thinks fit, without any reſtraint or controul, unleſs by the law of nature; being a right inherent in us by birth, and one of the gifts of God to man at his creation, when he endued him with the faculty of free-will. But every man, when he enters into ſociety, gives up a part of his natural liberty, as the price of ſo valuable a purchaſe; and, in conſideration of receiving the advantages of mutual commerce, obliges himſelf to conform to thoſe laws which the community has thought proper to eſtabliſh. And this ſpecies of legal obedience and conformity is infinitely more deſireable than that wild and ſavage liberty which is ſacrificed to obtain it. For no man, that conſiders a moment, would wiſh to retain the abſolute and uncontrouled power of doing whatever he pleaſes: the conſequence of which is, that every other man would alſo have the ſame power; and then there would be no ſecurity to individuals in any of the enjoyments of life.

Political, therefore, or *civil*, liberty, which is that of a member of ſociety, is no other than natural liberty, ſo far reſtrained by human laws (and no farther) as is neceſſary and expedient for the general advantage of the public. Hence we may collect, that the law, which reſtrains a man from doing miſchief to his fellow citizens, though it diminiſhes the natural, increaſes the civil liberty of mankind: but every wanton and cauſeleſs reſtraint of the will of the ſubject, whether practiſed by a monarch, a nobility, or a popular aſſembly, is a degree of tyranny. Nay, that even laws themſelves, whether made with or without our conſent, if they regulate and conſtrain our conduct in matters of mere indifference, without any good end in view, are laws deſtructive of liberty: whereas, if any public advantage can ariſe from obſerving ſuch precepts, the controul of our private inclinations, in one or two particular points, will conduce to preſerve our general freedom in others of more importance, by ſupporting that ſtate of ſociety which alone can ſecure our independence. Thus the ſtatute of king Edward IV. which forbad the fine gentlemen of thoſe times (under the degree of a lord) to wear pikes upon their ſhoes or boots of more than two inches in length, was a law that favoured of oppreſſion; becauſe, however

Liberty. ever ridiculous the fashion then in use might appear, the restraining it by pecuniary penalties could serve no purpose of common utility. But the statute of King Charles II. which prescribes a thing seemingly as indifferent, *viz.* a dress for the dead, who were all ordered to be buried in woollen, is a law consistent with public liberty; for it encourages the staple trade, on which in great measure depends the universal good of the nation. So that laws, when prudently framed, are by no means subversive, but rather introductive, of liberty; for (as Mr Locke has well observed) where there is no law there is no freedom. But then, on the other hand, that constitution or frame of government, that system of laws, is alone calculated to maintain civil liberty, which leaves the subject entire master of his own conduct, except in those points wherein the public good requires some direction or restraint.

The idea and practice of this political or civil liberty flourish in their highest vigour in these kingdoms, where it falls little short of perfection, and can only be lost or destroyed by the folly or demerits of its owner; the legislature, and of course the laws of Britain, being peculiarly adapted to the preservation of this inestimable blessing even in the meanest subject. Very different from the modern constitutions of other states on the continent of Europe, and from the genius of the imperial law; which in general are calculated to vest an arbitrary and despotic power, of controuling the actions of the subject, in the prince, or in a few grandees. And this spirit of liberty is so deeply implanted in our constitution, and rooted even in our very soil, that a slave or a negro, the moment he lands in Britain, falls under the protection of the laws, and so far becomes a freeman; though the master's right to his service may possibly still continue.

The absolute rights of every Briton (which, taken in a political and extensive sense, are usually called their *liberties*), as they are founded on nature and reason, so they are coeval with our form of government; though subject at times to fluctuate and change, their establishment (excellent as it is) being still human. At some times we have seen them depressed by overbearing and tyrannical princes; at others, so luxuriant as even to tend to anarchy, a worse state than tyranny itself, as any government is better than none at all. But the vigour of our free constitution has always delivered the nation from these embarrassments: and, as soon as the convulsions consequent on the struggle have been over, the balance of our rights and liberties has settled to its proper level; and their fundamental articles have been from time to time asserted in parliament, as often as they were thought to be in danger:

Blackst. Comment. First, by the great charter of liberties, which was obtained, sword in hand, from King John, and afterwards, with some alterations, confirmed in parliament by King Henry III. his son. Which charter contained very few new grants; but, as Sir Edward Coke observes, was for the most part declaratory of the principal grounds of the fundamental laws of England. Afterwards, by the statute called *confirmatio cartarum*, whereby the great charter is directed to be allowed as the common law; all judgments contrary to it are declared void; copies of it are ordered to be sent to all cathedral churches, and read twice a-year to the people; and sentence of excommunication is directed to be as constantly denounced against all those that by word, deed, or counsel, act contrary thereto, or in any degree infringe it. Next by a multitude of subsequent corroborating statutes (Sir Edward Coke reckons 32), from the first Edward to Henry IV. Then, after a long interval, by *the petition of right;* which was a parliamentary declaration of the liberties of the people, assented to by King Charles I. in the beginning of his reign. Which was closely followed by the still more ample concessions made by that unhappy prince to his parliament, before the fatal rupture between them; and by the many salutary laws, particulary the *habeas corpus* act, passed under Charles II. To these succeeded *the bill of rights*, or declaration delivered by the lords and commons to the prince and princess of Orange, 13th February 1688; and afterwards enacted in parliament, when they became king and queen: which declaration concludes in these remarkable words; "and they do claim, demand, and insist upon, all and singular the premises, as their undoubted rights and liberties." And the act of parliament itself recognises "all and singular the rights and liberties asserted and claimed in the said declaration to be the true, ancient, and indubitable rights of the people of this kingdom." Lastly, these liberties were again asserted at the commencement of the present century, in the *act of settlement*, whereby the crown was limited to his present majesty's illustrious house: and some new provisions were added, at the same fortunate era, for better securing our religion, laws, and liberties; which the statute declares to be "the birthright of the people of England," according to the ancient doctrine of the common law.

Thus much for the *declaration* of our rights and liberties. The rights themselves, thus defined by these several statutes, consist in a number of private immunities; which will appear, from what has been premised, to be indeed no other, than either that *residuum* of natural liberty, which is not required by the laws of society to be sacrificed to public convenience; or else those civil privileges, which society hath engaged to provide, in lieu of the natural liberties so given up by individuals. These therefore were formerly, either by inheritance or purchase, the rights of all mankind; but, in most other countries of the world, being now more or less debased and destroyed, they at present may be said to remain, in a peculiar and emphatical manner, the rights of the people of Britain. And these may be reduced to three principal or primary articles; the right of personal security, the right of personal liberty, and the right of private property: because, as there is no other known method of compulsion, or of abridging man's natural free-will, but by an infringement or diminution of one or other of these important rights, the preservation of these inviolate may justly be said to include the preservation of our civil immunities in their largest and most extensive sense. See the article RIGHTS.

In vain, however, would these rights be declared, ascertained, and protected by the dead letter of the laws, if the constitution had provided no other method to secure their actual enjoyment. It has therefore established certain other auxiliary subordinate rights of the subject, which serve principally as barriers to protect and maintain inviolate the three great and primary

Liberty. mary rights, of perſonal ſecurity, perſonal liberty, and private property. Theſe are,

1. The conſtitution, powers, and privileges of parliament; for which ſee PARLIAMENT.

2. The limitation of the king's prerogative, by bounds ſo certain and notorious, that it is impoſſible he ſhould exceed them without the conſent of the people; as to which, ſee PREROGATIVE. The former of theſe keeps the legiſlative power in due health and vigour, ſo as to make it improbable that laws ſhould be enacted deſtructive of general liberty: the latter is a guard upon the executive power, by reſtraining it from acting either beyond or in contradiction to the laws that are framed and eſtabliſhed by the other.

3. A third ſubordinate right of every Briton is that of applying to the courts of juſtice for redreſs of injuries. Since the law is, in this realm, the ſupreme arbiter of every man's life, liberty, and property, courts of juſtice muſt at all times be open to the ſubject, and the law be duly adminiſtered therein. The emphatical words of *magna carta*, ſpoken in the perſon of the king, who in judgment of law (ſays Sir Edward Coke) is ever preſent and repeating them in all his courts, are theſe: *Nulli vendemus, nulli negabimus, aut differemus rectum vel juſtitiam*; "and therefore every ſubject (continues the ſame learned author), for injury done to him *in bonis, in terris, vel perſona*, by any other ſubject, be he eccleſiaſtical or temporal, without any exception, may take his remedy by the courſe of the law, and have juſtice and right for the injury done to him, freely without ſale, fully without any denial, and ſpeedily without delay." It were endleſs to enumerate all the *affirmative* acts of parliament, wherein juſtice is directed to be done according to the law of the land: and what that law is, every ſubject knows; or may know if he pleaſes: for it depends not upon the arbitrary will of any judge; but is permanent, fixed, and unchangeable, unleſs by authority of parliament. We ſhall however juſt mention a few *negative* ſtatutes, whereby abuſes, perverſions, or delays of juſtice, eſpecially by the prerogative, are reſtrained. It is ordained by *magna carta*, that no freeman ſhall be outlawed, that is, put out of the protection and benefit of the laws, but according to the law of the land. By 2 Edw. III. c. 8. and 11 Ric. II. c. 10. it is enacted, that no commands or letters ſhall be ſent under the great ſeal, or the little ſeal, the ſignet or privy ſeal, in diſturbance of the law; or to diſturb or delay common right: and, though ſuch commandments ſhould come, the judges ſhall not ceaſe to do right: which is alſo made a part of their oath by ſtatute 18 Edw. III. ſt. 4. And by 1 W. & M. ſt. 2. c. 2. it is declared, that the pretended power of ſuſpending or diſpenſing with laws, or the execution of laws, by regal authority without conſent of parliament, is illegal.

Not only the ſubſtantial part, or judicial deciſions, of the law, but alſo the formal part, or method of proceeding, cannot be altered but by parliament: for, if once thoſe outworks were demoliſhed, there would be an inlet to all manner of innovation in the body of the law itſelf. The king, it is true, may erect new courts of juſtice; but then they muſt proceed according to the old eſtabliſhed forms of the common law. For which reaſon it is declared in the ſtatute 16 Car. I. c. 10. upon the diſſolution of the court of ſtar-chamber, that neither his majeſty, nor his privy-council, have any juriſdiction, power, or authority, by Engliſh bill, petition, articles, libel (which were the courſe of proceeding in the ſtar-chamber, borrowed from the civil law), or by any other arbitrary way whatſoever, to examine, or draw into queſtion, determine, or diſpoſe of the lands or goods of any ſubjects of this kingdom; but that the ſame ought to be tried and determined in the ordinary courts of juſtice, and by *courſe of law*. Liberty.

4. If there ſhould happen any uncommon injury, or infringement of the rights before mentioned, which the ordinary courſe of law is too defective to reach, there ſtill remains a fourth ſubordinate right, appertaining to every individual, namely, the right of petitioning the king, or either houſe of parliament, for the redreſs of grievances. In Ruſſia we are told, that the Czar Peter eſtabliſhed a law, that no ſubject might petition the throne till he had firſt petitioned two different miniſters of ſtate. In caſe he obtained juſtice from neither, he might then preſent a third petition to the prince; but upon pain of death, if found to be in the wrong. The conſequence of which was, that no one dared to offer ſuch third petition; and grievances ſeldom falling under the notice of the ſovereign, he had little opportunity to redreſs them. The reſtrictions, for ſome there are, which are laid upon petitioning in Britain, are of a nature extremely different; and while they promote the ſpirit of peace, they are no check upon that of liberty. Care only muſt be taken, leſt, under the pretence of petitioning, the ſubject be guilty of any riot or tumult; as happened in the opening of the memorable parliament in 1640: and, to prevent this, it is provided by the ſtatute 13 Car. II. ſt. 1. c. 5. that no petition to the king, or either houſe of parliament, for any alteration in church or ſtate, ſhall be ſigned by above 20 perſons, unleſs the matter thereof be approved by three juſtices of the peace, or the major part of the grand jury, in the country; and in London, by the lord mayor, aldermen, and common-council: nor ſhall any petition be preſented by more than 10 perſons at a time. But, under theſe regulations, it is declared by the ſtatute 1 W. & M. ſt. 2. c. 2. that the ſubject hath a right to petition; and that all commitments and proſecutions for ſuch petitioning are illegal.

5. The fifth and laſt auxiliary right of the ſubject, that we ſhall at preſent mention, is that of having arms for their defence, ſuitable to their condition and degree, and ſuch as are allowed by law. Which is alſo declared by the ſame ſtatute 1 W. & M. ſt. 2. c. 2. and is indeed a public allowance, under due reſtrictions, of the natural right of reſiſtance and ſelf-preſervation, when the ſanctions of ſociety and laws are found inſufficient to reſtrain the violence of oppreſſion.

In theſe ſeveral articles conſiſt the rights, or, as they are frequently termed, *the liberties of Britons*: liberties more generally talked of, than thoroughly underſtood; and yet highly neceſſary to be perfectly known and conſidered by every man of rank or property, leſt his ignorance of the points whereon they are founded ſhould hurry him into faction and licentiouſneſs on the one hand, or a puſillanimous indiffe-

Liberty. rence and criminal ſubmiſſion on the other. And we have ſeen that theſe rights conſiſt, primarily, in the free enjoyment of perſonal ſecurity, of perſonal liberty, and of private property. So long as theſe remain inviolate, the ſubject is perfectly free; for every ſpecies of compulſive tyranny and oppreſſion muſt act in oppoſition to one or other of theſe rights, having no other object upon which it can poſſibly be employed. To preſerve theſe from violation, it is neceſſary that the conſtitution of parliaments be ſupported in its full vigour; and limits, certainly known, be ſet to the royal prerogative. And, laſtly, to vindicate theſe rights, when actually violated or attacked, the ſubjects of Britain are intitled, in the firſt place, to the regular adminiſtration and free courſe of juſtice in the courts of law; next, to the right of petitioning the king and parliament for redreſs of grievances; and, laſtly, to the right of having and uſing arms for ſelf preſervation and defence. And all theſe rights and liberties it is our birthright to enjoy entire; unleſs where the laws of our country have laid them under neceſſary reſtraints. Reſtraints in themſelves ſo gentle and moderate, as will appear upon farther inquiry, that no man of ſenſe or probity would wiſh to ſee them ſlackened. For all of us have it in our choice to do every thing that a good man would deſire to do; and are reſtrained from nothing, but what would be pernicious either to ourſelves or our fellow-citizens. So that this review of our ſituation may fully juſtify the obſervation of a learned French author, who indeed generally both thought and wrote in the ſpirit of genuine freedom; and who hath not ſcrupled to profeſs, even in the very boſom of his native country, that the Britiſh is the only nation in the world, where political or civil liberty is the direct end of its conſtitution. Recommending therefore to the ſtudent in our laws a farther and more accurate ſearch into this extenſive and important title, we ſhall cloſe our remarks upon it with the expiring wiſh of the famous Father Paul to his country, "ESTO PERPETUA!"

LIBERTY and Neceſſity. See METAPHYSICS.

LIBERTY of the Preſs. The art of printing, ſoon after its introduction, was looked upon in England, as well as in other countries, as merely a matter of ſtate, and ſubject to the coercion of the crown. It was therefore regulated with us by the king's proclamations, prohibitions, charters of privilege and licence, and finally by the decrees of the court of ſtar-chamber, which limited the number of printers, and of preſſes which each ſhould employ, and prohibited new publications unleſs previouſly approved by proper licenſers. On the demolition of this odious juriſdiction in 1641, the long parliament of Charles I. after their rupture with that prince, aſſumed the ſame powers as the ſtar-chamber had exerciſed with reſpect to the licenſing of books: and in 1643, 1647, 1649, and 1652 (Scobell. i. 44, 134. ii. 88, 230.) iſſued their ordinances for that purpoſe, founded principally on the ſtar-chamber decree of 1637. In 1662, was paſſed the ſtatute 13 & 14 Car. II. c. 33. which, with ſome few alterations, was copied from the parliamentary ordinances. This act expired in 1679; but was revived by ſtatute 1 Jac. II. c. 17. and continued till 1692. It was then continued for two years longer by ſtatute 4 W. & M. c. 24. but though frequent attempts were made by the government to revive it, in the ſubſequent part of that reign (Com. Journ. 11 Feb. 1694. 26 Nov. 1695. 22 Oct. 1696. 9 Feb. 1697. 31 Jan. 1698.) yet the parliament reſiſted it ſo ſtrongly, that it finally expired, and the preſs became properly free in 1694, and has continued ſo ever ſince. Liberty; Libethra.

The liberty of the preſs, however, ſo eſſential to the nature of a free ſtate, conſiſts not in freedom from cenſure for any criminal matter that may be publiſhed, but in laying no previous reſtraints upon publications. Every freeman has undoubtedly a right to lay what ſentiments he pleaſes before the public; to forbid this, is to deſtroy the freedom of the preſs: but if he publiſhes what is improper, miſchievous, or illegal, he muſt take the conſequence of his own temerity †. To ſubject the preſs to the reſtrictive power of a licenſer in the manner above mentioned, is to ſubject all freedom of ſentiment to the prejudices of one man, and make him the arbitrary and infallible judge of all controverted points in learning, religion, and government. But to puniſh (as the law does at preſent) any dangerous or offenſive writings which, when publiſhed, ſhall, on a fair and impartial trial, be adjudged of a pernicious tendency, is neceſſary for the preſervation of peace and good order, of government and religion, the only ſolid foundations of civil liberty. Thus the will of individuals is ſtill left free; the abuſe only of that free-will is the object of legal puniſhment. Neither is any reſtraint hereby laid upon freedom of thought or inquiry; liberty of private ſentiment is ſtill left; the diſſeminating or making public of bad ſentiments, deſtructive of the ends of ſociety, is the crime which ſociety corrects. A man (ſays a fine writer on this ſubject) may be allowed to keep poiſons in his cloſet, but not publicly to vend them as cordials. And to this we may add, that the only plauſible argument heretofore uſed for reſtraining the juſt freedom of the preſs, "that it was neceſſary to prevent the daily abuſe of it," will entirely loſe its force, when it is ſhown (by a ſeaſonable exertion of the laws) that the preſs cannot be abuſed to any bad purpoſe without incurring a ſuitable puniſhment: whereas, it can never be uſed to any good one when under the controul of an inſpector. So true will it be found, that to cenſure the licentiouſneſs, is to maintain the liberty of the preſs.

† See *Libel*.

LIBERTY, in mythology, was a goddeſs both among the Greeks and Romans. Among the former ſhe was invoked under the title *Eleutheria*; and by the latter ſhe was called *Libertas*, and held in ſingular veneration; temples, altars, and ſtatues, were erected in honour of this deity. A very magnificent temple was conſecrated to her on mount Aventin, by Tiberius Gracchus, before which was a ſpacious court, called *atrium libertatis*. The Romans alſo erected a new temple in honour of Liberty, when Julius Cæſar eſtabliſhed his empire over them, as if their liberty had been ſecured by an event which proved fatal to it. In a medal of Brutus, Liberty is exhibited under the figure of a woman, holding in one hand a cap, the ſymbol of Liberty, and two poinards in the other, with the inſcription IDIBVS MARTIIS.

LIBETHRA (anc. geog.), the fountain of ſong, was ſituated in Magneſia, a diſtrict of Macedonia annexed to Theſſaly; diſtinct from the town of Libethra, which ſtood on the mount Olympus, where it

Libethrius || Libra.

verges towards Macedonia: hence the Muſes are called *Libethrides*, (Virgil.) Strabo places on Helicon, not only Hippocrene, and the temple of the Muſes, but alſo the cave of the nymphs Libethrides.

LIBETHRIUS MONS (anc. geog.), a mountain of Bœotia, diſtant from Coronea 40 ſtadia; where ſtood the ſtatues of the Muſes, and of the nymphs, ſurnamed *Libethride*. A mountain probably conjoined with, or at leaſt very near to, Helicon.

LIBITINA, in the Roman mythology, a goddeſs which preſided over funerals. This goddeſs was the ſame with the *Venus infera* or *Epithymbia* of the Greeks. She had a temple at Rome, where was lodged a certain piece of money for every perſon who died, whoſe name was recorded in a regiſter called *Libitinæ ratio*. This practice was eſtabliſhed by Servius Tullius, in order to obtain an account of the number of annual deaths in the city of Rome, and conſequently the rate of increaſe or decreaſe of its inhabitants.

LIBITINARII, were undertakers whoſe office it was to take care of funerals, prepare all things neceſſary upon the ſolemn occaſion, and furniſh every article required.—They got their livelihood by this gloomy buſineſs, and kept a number of ſervants to perform the working part of the profeſſion, ſuch as the *pollinctores*, *veſpillones*, &c. The name *Libitinarii* is derived from *Libitina*, the goddeſs of funerals, in whoſe temple were ſold all things relating to funerals. See FUNERAL.

LIBNA (anc. geog.), a ſacerdotal city in the tribe of Judah, a place of ſtrength, as appears from Sennacherib's laying ſiege to it, 2 Kings xix. Iſaiah xxxvii. In Jerome's time, a village, called *Lobna*, in the territory of Eleutheropolis.

LIBOURNE, a town of France, in Guienne, and in Bourdelois. It is a populous trading town, and is ſeated on the river Dordogne. W. Long. 0. 10. N. Lat. 44. 55.

LIBRA, or BALANCE, one of the mechanical powers. See BALANCE.

LIBRA, in aſtronomy, one of the 12 ſigns of the zodiac, and exactly oppoſite to Aries; ſo called becauſe when the ſun is in this ſign at the autumnal equinox, the days and nights are equal as if weighed in a balance.—The ſtars in this conſtellation according to Ptolemy are 17, Tycho 10, Hevelius 20, and Flamſtead 51.

LIBRA alſo denotes the ancient Roman pound, borrowed from the Sicilians, who called it *litra*.

The libra was divided into 12 *unciæ* or ounces, and the ounce into 24 ſcruples.

The diviſions of the libra were, the *uncia*, one twelfth; the *ſextans*, one ſixth; the *quadrans*, one fourth; the *triens*, one third; the *quincunx*, five ounces; the *ſemis*, ſix; the *ſeptunx*, ſeven: the *bes*, eight; the *dodrans*, nine: the *dextrans*, ten; the *deunx*, eleven; laſtly, the *as* weighed twelve ounces or one libra.

The Roman libra was uſed in France for the proportions of their coin till the time of Charlemagne, or perhaps till that of Philip I. in 1093, their ſols being ſo proportioned, as that 20 of them were equal to the libra. By degrees it became a term of account; and every thing of the value of twenty ſols was called a *livre*.

LIBRA penſa, in our law books, denotes a pound of money in weight. It was uſual in former days not only to tell the money but to weigh it: becauſe many cities, lords, and biſhops, having their mints, coined money, and often very bad too; for which reaſon, though the pound conſiſted of 20 ſhillings, they always weighed it.

Libra || Library.

LIBRARII, among the ancients, were a ſort of copyiſts who tranſcribed in beautiful or at leaſt legible characters, what had been written by the notarii in notes and abbreviatures.

LIBRARY, an edifice or apartment deſtined for holding a conſiderable number of books placed regularly on ſhelves; or the books themſelves lodged in it.

Some authors refer the origin of libraries to the Hebrews; and obſerve, that the care theſe took for the preſervation of their ſacred books, and the memory of what concerned the actions of their anceſtors, became an example to other nations, particularly to the Egyptians. Oſmanduas, king of Egypt, is ſaid to have taken the hint firſt; who, according to Diodorus, had a library built in his palace, with this inſcription over the door, ΨΥΧΗΣ ΙΑΤΡΕΙΟΝ. Nor were the Ptolemies, who reigned in the ſame country, leſs curious and magnificent in books.

The ſcripture alſo ſpeaks of a library of the kings of Perſia, Ezra v. 17. vi. 1. which ſome imagine to have conſiſted of the hiſtorians of that nation, and of memoirs of the affairs of ſtate; but, in effect, it appears rather to have been a depoſitory of laws, charters, and ordinances of the kings. The Hebrew text calls it the *houſe of treaſures*, and afterwards the *houſe of the rolls*, where the treaſures were laid up. We may, with more juſtice, call that a *library*, mentioned in the ſecond of Eſdras to have been built by Nehemiah, and in which were preſerved the books of the prophets, and of David, and the letters of their kings.

The firſt who erected a library at Athens, was the tyrant Piſiſtratus: and yet Strabo refers the honour of it to Ariſtotle. That of Piſiſtratus was tranſported by Xerxes into Perſia, and was afterwards brought back by Seleucus Nicanor to Athens. Long after, it was plundered by Sylla, and re-eſtabliſhed by Hadrian. Plutarch ſays, that under Eumenes there was a library at Pergamus, containing 200,000 books. Tyrannian, a celebrated grammarian, contemporary with Pompey, had a library of 30,000 volumes. That of Ptolemy Philadelphus, according to A. Gellius, contained 700,000, all in rolls, burnt by Cæſar's ſoldiers.

Conſtantine, and his ſucceſſors, erected a magnificent one at Conſtantinople; which in the eighth century contained 300,000 volumes, all burnt by order of Leo Iſaurus; and, among the reſt, one wherein the Iliad and Odyſſey were written in letters of gold, on the guts of a ſerpent.

The moſt celebrated libraries of ancient Rome, were the Ulpian, and the Palatine. They alſo boaſt much of the libraries of Paulus Æmilius, who conquered Perſeus; of Lucilius Lucullus, of Aſinius Pollio, Atticus, Julius Severus, Domitius, Serenus, Pamphilius Martyr, and the emperors Gordian and Trajan.

Anciently, every large church had its library; as appears by the writings of St Jerome, Anaſtaſius, and others. Pope Nicholas laid the firſt foundation of

Library. that of the Vatican, in 1450. It was deſtroyed by the conſtable Bourbon, in the ſacking of Rome, and reſtored by Pope Sixtus V. and has been conſiderably enriched with the ruins of that of Heidelberg, plundered by Count Tilly in 1622. One of the moſt complete libraries in Europe, was ſaid to be that erected at Florence by Coſmo de Medicis, over the gate whereof is written, LABOR ABSQUE LABORE; though it is now exceeded by that of the French king, begun by Francis I. augmented by Cardinal Richelieu, and completed by M. Colbert.

The emperor's library at Vienna, according to Lambecius, conſiſts of 80,000 volumes, and 15,940 curious medals.

The Bodleian library at Oxford, built on the foundation of that of Duke Humphry, exceeds that of any univerſity in Europe, and even thoſe of all the ſovereigns of Europe, except the emperor's and French king's, which are each of them older by 100 years. It was firſt opened in 1602, and has ſince found a great number of benefactors; particularly Sir Robert Cotton, Sir H. Savil, Archbiſhop Laud, Sir Kenelm Digby, Mr Allen, Dr Pococke, Mr Selden, and others. The Vatican, the Medicean, that of Beſſarion at Venice, and thoſe juſt mentioned, exceed the Bodleian in Greek manuſcripts: which yet outdoes them all in Oriental manuſcripts.

As to printed books, the Ambroſian at Milan, and that of Wolfenbuttle, are two of the moſt famous, and yet both inferior to the Bodleian.

King's LIBRARY, at St James's, was founded by Henry, eldeſt ſon of James I. and made up partly of books, and partly of manuſcripts, with many other curioſities, for the advancement of learning. It has received many additions from the libraries of Iſaac Caſaubon and others.

Cottonian LIBRARY, originally conſiſted of 958 volumes of original charters, grants, inſtruments, letters of ſovereign princes, tranſactions between this and other kingdoms and ſtates, genealogies, hiſtories, regiſters of monaſteries, remains of Saxon laws, the book of Geneſis, thought to be the moſt ancient Greek copy extant, and ſaid to have been written by Origen in the ſecond century, and the curious Alexandrian copy or manuſcript in Greek capitals. This library is kept in the Britiſh Muſeum, with the large and valuable library of Sir Hans Sloane, amounting to upwards of 42,000 volumes, &c. There are many public libraries belonging to the ſeveral colleges at Oxford and Cambridge, and the univerſities in North Britain. The principal public libraries in London, beſide that of the Muſeum, are thoſe of the college of heralds, of the college of phyſicians, of Doctors Commons, to which every biſhop, at the time of his conſecration, gives at leaſt 20l. ſometimes 50l. for the purchaſe of books; thoſe of the Gray's Inn, Lincoln's Inn, Inner Temple, and Middle Temple; that of Lambeth, founded by Archbiſhop Bancroft in 1610, for the uſe of ſucceeding archbiſhops of Canterbury, and increaſed by the benefactions of Archbiſhops Abbot, Sheldon, and Tenniſon, and ſaid to conſiſt of at leaſt 15,000 printed books, and 617 volumes in manuſcript; that of Red-Croſs ſtreet, founded by Dr Daniel Williams, a Preſbyterian divine, and ſince enriched by many private benefactions; that of the Royal Society, called the *Arundelian* or *Norfolk library*, becauſe the principal part of the collection formerly belonged to the family of Arundel, and was given to the ſociety by Henry Howard, afterwards duke of Norfolk, in 1666, which library has been increaſed by the valuable collection of Francis Aſton, Eſq; in 1715, and is continually increaſing by the numerous benefactions of the works of its learned members, and others: that of St Paul's, of Sion college; the queen's library, erected by Queen Caroline in 1737; and the ſurgeon's library, kept in their hall in the Old Bailey, &c.

Libration ‖ Libya.

In Edinburgh there is a good library belonging to the univerſity, well furniſhed with books; which are kept in good order. There is alſo a noble library of books and manuſcripts belonging to the faculty of advocates. See ADVOCATE.

LIBRATION, in aſtronomy, an apparent irregularity of the moons's motion, whereby ſhe ſeems to librate about her axis, ſometimes from the eaſt to the weſt, and now and then from the weſt to the eaſt. See ASTRONOMY, n° 420.

LIBURNIA (anc. geog.), a diſtrict of Illyricum, extending towards the Adriatic between Iſtria on the weſt, Dalmatia on the eaſt, and mount Albius on the north. *Liburni*, the people. The apparitors, who at the command of the magiſtrate ſummoned the people from the country, were called *Liburni*, becauſe generally men of *Liburnia*.—*Liburna*, or *Liburnica*, (Horace), denoted a kind of light and ſwift ſkiff, uſed by the Liburnians in their ſea-rovings or piracies, for which they were noted. *Liburnum* (Juvenal) was a ſpecies of litter made in form of Liburnian ſkiffs, wherein the noblemen of Rome were carried, and where they ſat at their eaſe, either reading or writing.

LIBURNUS (anc. geog.), a mountain of Campania. Alſo a port of Tuſcany. Now *Livorno*, or *Leghorn*. E. Long. 11. N. Lat. 43. 30.

LIBYA, in general, according to the Greeks, denoted Africa. An appellation derived from *lub*, "thirſt," being a dry and thirſty country. See AFRICA.

LIBYA, in a more reſtrained ſenſe, was the middle part of Africa, extending north and weſt, (Pliny); between the Mediterranean to the north, and Ethiopia to the eaſt; and was two-fold, the *Hither* or *Exterior Libya*; and the *Farther* or *Interior*. The former lay between the Mediterranean on the north, and the *Farther Libya* and Ethiopia beyond Egypt on the ſouth, (Ptolemy). The *Farther* or *Interior Libya*, was a vaſt country, lying between the *Hither Libya* on the north, the Atlantic ocean on the weſt, the Ethiopic on the ſouth, and Ethiopia beyond Egypt on the eaſt, (Ptolemy).

LIBYA, in a ſtill more reſtrained ſenſe, called, for diſtinction's ſake, *Libya Propria*, was a northern diſtrict of Africa, and a part of the *Hither Libya*; ſituated between Egypt to the eaſt, the Mediterranean to the north, the Syrtis Major and the Regio Tripolitana to the weſt, the Garamantes and Ethiopia beyond Egypt to the ſouth. Now the kingdom and deſart of *Barca*. This Libya was again ſubdivided into *Libya* taken in the ſtricteſt ſenſe of all, and into Marmarica and Cyrenaica. *Libya* in the ſtricteſt ſenſe, otherwiſe the *Exterior*, was the moſt eaſtern part of *Libya Propria*, next to Egypt, with Marmarica on the weſt, the Me-

Licence ‖ Lichen.

Mediterranean on the north, and the Nubi, now called *Nubia*, to the ſouth, (Ptolemy).

LICENCE, in law, an authority given to a perſon to do ſome lawful act.

LICENSER *of the Preſs*. See LIBERTY *of the Preſs*.

LICENTIATE, one who has obtained the degree of a licence.—The greateſt number of the officers of juſtice in Spain are diſtinguiſhed by no other title than that of *licentiate*. In order to paſs *licentiate* in common law, civil law, and phyſic, they muſt have ſtudied ſeven years, and in divinity ten. Among us a *licentiate* uſually means a phyſician who has a licence to practiſe, granted by the college of phyſicians.

LICETUS, a celebrated phyſician of Italy, was born at Rappollo, in the ſtate of Genoa, 1577. He came, it ſeems, into the world, before his mother had completed the ſeventh month of her pregnancy; but his father, being an ingenious phyſician, wrapped him up in cotton, and nurtured him ſo, that he lived to be 77 years of age. He was trained with great care, and became a very diſtinguiſhed man in his profeſſion; and was the author of a great number of works: his book *De Monſtris* every body muſt have heard of. He was profeſſor of philoſophy and phyſic at Padua, where he died in 1655.

LICHEN, LIVER WORT, in botany; a genus of the natural order of algæ, belonging to the cryptogamia claſs of plants. The male receptacle is roundiſh, ſomewhat plain and ſhining. In the female the leaves have a farina or mealy ſubſtance ſcattered over them. There are about 130 ſpecies, all found in Britain. Among the moſt remarkable are the following:

1. The geographicus; it is frequent in rocks, and may be readily diſtinguiſhed at a diſtance. The cruſt or ground is of a bright greeniſh-yellow colour, ſprinkled over with numerous plain black tubercles; which frequently run into one another, and form lines reſembling the rivers in a map, from which laſt circumſtance it takes its name.

2. The calcarious, or black-nobbed dyer's lichen, is frequent on calcarious rocks; and hath a hard, ſmooth, white, ſtoney, or tartareous cruſt, cracked or teſſelated on the ſurface, with black tubercles. Dillenius relates, that this ſpecies is uſed in dyeing, in the ſame manner as the *tartareus* after mentioned.

3. The ventoſus, or red ſpangled tartareous lichen, hath a hard tartareous cruſt, cracked and teſſelated on the ſurface, of a pale yellow colour when freſh, and a light olive when dry. The tubercles are of a blood-red colour at top, their margin and baſe of the ſame colour as the cruſt. The texture and appearance of this (according to Mr Lightfoot), indicate that it would anſwer the purpoſes of dyeing as well as ſome others of this tribe, if proper experiments were made.

4. The candelarius, or yellow farinaceous lichen, is common upon walls, rocks, boards, and old pales. There are two varieties. The firſt has a farinaceous cruſt of no regular figure, covered with numerous, ſmall, greeniſh-yellow, or olive ſhields, and grows commonly upon old boards. The other has a ſmooth, hard, circular cruſt, wrinkled and lobed at the circumference, which adheres cloſely to rocks and ſtones. In the centre are numerous ſhields of a deeper yellow or orange colour, which, as they grow old, ſwell in the middle, and aſſume the figure of tubercles. The inhabitants of Smaland in Sweden ſcrape this lichen from the rocks, and mix it with their tallow, to make golden candles to burn on feſtival days. Lichen.

5. The tartarius, or large yellow-ſaucer'd dyer's lichen, is frequent on rocks, both in the Highlands and Lowlands of Scotland. The cruſt is thick and tough, either white, or greeniſh-white, and has a rough warted ſurface. The ſhields are yellow or buff-coloured, of various ſizes, from that of a pin's head to the diameter of a ſilver penny. Their margins are of the ſame colour as the cruſt. This lichen is much uſed by the Highlanders for dyeing a fine claret or pompadour colour. For this purpoſe, after ſcraping it from the rocks, and cleaning it, they ſteep it in urine for a quarter of a year. Then taking it out, they make it into cakes, and hang them up in bags to dry. Theſe cakes are afterwards pulveriſed, and the powder is uſed to impart the colour with an addition of alum.

6. The parellus, or crawfiſh-eye lichen, grows upon walls and rocks, but is not very common. The cruſts ſpread cloſely upon the place where they grow, and cover them to a conſiderable extent. They are rough, tartareous, and aſh-coloured, of a tough coriaceous ſubſtance. The ſhields are numerous and crowded, having white or aſh-coloured, ſhallow, plain diſcs, with obtuſe margins. This is uſed by the French for dyeing a red colour.

7. The ſaxatilis, or grey-blue pitted lichen, is very common upon trunks of trees, rocks, tiles, and old wood. It forms a circle two or three inches diameter. The upper ſurface is of a blue-grey and ſometimes of a whitiſh aſh-colour, uneven, and full of numerous ſmall pits or cavities; the under ſide is black, and covered all over, even to the edges, with ſhort ſimple hairs or radicles. A variety ſometimes occurs with leaves tinged of a red or purple colour. This is uſed by finches and other ſmall birds in conſtructing the outſide of their curiouſly formed neſts.

8. The omphalodes, or dark-coloured dyers lichen, is frequent upon rocks. It forms a thick widely expanded cruſt of no regular figure, compoſed of numerous imbricated leaves of a brown or dark-purple colour, divided into ſmall ſegments. The margins of the ſhields are a little criſped and turned inwards, and their outſide aſh-coloured. The lichen is much uſed by the Highlanders in dyeing a reddiſh brown colour. They ſteep it in urine for a conſiderable time, till it becomes ſoft and like a paſte; then, forming the paſte into cakes, they dry them in the ſun, and preſerve them for uſe in the manner already related of the tartarius.

9. The parietinus, or common yellow wall-lichen, is very common upon walls, rocks, tiles of houſes, and trunks of trees. It generally ſpreads itſelf in circles of two or three inches diameter, and is ſaid to dye a good yellow or orange colour with alum.

10. The iſlandicus, or eatable Iceland lichen, grows on many mountains both of the Highlands and Lowlands of Scotland. It conſiſts of nearly erect leaves about two inches high, of a ſtiff ſubſtance when dry, but ſoft and pliant when moiſt, variouſly divided without order into broad diſtant ſegments, bifid or trifid at the extremities. The upper or interior ſurface of the leaves is concave, cheſnut colour, ſmooth, and ſhining, but red at the baſe; the under or exterior ſurface is ſmooth and whitiſh, a little pitted, and ſprinkled with very minute black warts. The margins of the leaves and all the ſegments from bottom to top are ciliated with ſmall,

Lichen. ſhort, ſtiff, hair-like ſpinules, of a dark cheſnut colour, turning towards the upper ſide. The ſhields are very rarely produced. For the uſes of this as an eſculent herb, ſee ICELAND, n° 10. Made into broth or gruel, it is ſaid to be very ſerviceable in coughs and conſumptions; and, according to Haller and Scopoli, is much uſed in theſe complaints in Vienna.

11. The pulmonarius, or lung-wort lichen, grows in ſhady woods upon the trunks of old trees. The leaves are as broad as a man's hand, of a kind of leather-like ſubſtance, hanging looſe from the trunk on which it grows, and laciniated into wide angular ſegments. Their natural colour, when freſh, is green; but in drying, they turn firſt to a glaucous and afterwards to a fuſcous colour. It has an aſtringent, bitter taſte; and, according to Gmelin, is boiled in ale in Siberia, inſtead of hops. The ancients uſed it in coughs and aſthmas, &c. but it is not uſed in modern practice.

12. The calicaris, or beaked lichen, grows ſometimes upon trees, but more frequently upon rocks, eſpecially on the ſea-coaſts, but is not very common. It is ſmooth, gloſſy, and whitiſh, producing flat or convex ſhields, of the ſame colour as the leaves, very near the ſummits of the ſegments, which are acute and rigid, and, being often reflected from the perpendicular by the growth of the ſhields, appear from under their limbs like a hooked beak. This will dye a red colour; and promiſes, in that intention, to rival the famous *Lichen Rocolla* or *Argol*, which is brought from the Canary Iſlands, and ſometimes ſold at the price of 80 l. per ton. It was formerly uſed inſtead of ſtarch to make hair-powder.

13. The prunaſtri, or common ragged hoary lichen, grows upon all ſorts of trees; but it is generally moſt white and hoary on the ſloe and old palm trees, or upon old pales. This is the moſt variable of the whole tribe of lichens, appearing different in figure, magnitude, and colour, according to its age, place of growth, and ſex. The young plants are of a glaucous colour, ſlightly divided into ſmall acute creſted ſegments. As they grow older, they are divided like a ſtag's horn, into more and deeper ſegments, ſomewhat broad, flat, ſoft, and pitted on both ſides, the upper ſurface of a glaucous colour, the under one white and hoary.—The *male* plants, as Linnæus terms them, are ſhort, ſeldom more than an inch high, not hoary on the under ſide; and have pale glaucous ſhields ſituated at the extremities of the ſegments, ſtanding on ſhort peduncles, which are only ſmall ſtiff portions of the leaf produced.—The female ſpecimens have numerous farinaceous tubercles both on the edges of their leaves, and the wrinkles of their ſurface.—The pulveriſed leaves have been uſed as a powder for the hair, and alſo in dyeing yarn of a red colour.

14. The juniperinus, or common yellow tree-lichen, is common upon the trunks and branches of elms and many other trees. Linnæus ſays it is very common upon the juniper. The Gothland Swedes dye their yarn of a yellow colour with it, and give it as a ſpecific in the jaundice.

15. The caninus, or aſh-coloured ground-liverwort, grows upon the ground among moſs, at the roots of trees in ſhady woods, and is frequent alſo in heaths and ſtony places. The leaves are large, gradually dilated towards the extremities, and divided into roundiſh elevated lobes. Their upper ſide, in dry weather, is aſh-coloured; in rainy weather, of a dull fuſcous green colour; their under-ſide white and hoary, having many thick downy nerves, from which deſcend numerous, long, white, pencil-like radicles. The peltæ, or ſhields, grow at the extremities of the elevated lobes, ſhaped like the human nail; of a roundiſh oval form, convex above, and concave beneath; of a chocolate colour on the upper ſide, and the ſame colour with the leaves on the under. There are two varieties, the one called *reddiſh*, and the other *many-fingered*, ground-liverwort. The former is more common than the other. This ſpecies has been rendered famous by the celebrated Dr Mead, who aſſerted that it was an infallible preventative of the dreadful conſequences attending the bite of a mad dog. He directed half an ounce of the leaves dried and pulveriſed to be mixed with two drachms of powdered black pepper. This was to be divided into four doſes, one of which was to be taken by the patient every morning faſting, for four mornings ſucceſſively, in half a pint of warm cow's milk; after which he was to uſe the cold bath every morning for a month. It is much to be lamented, however, that the ſucceſs of this medicine, or indeed any other recommended for the ſame purpoſe, hath not always anſwered the expectation. There are inſtances where the application has not prevented the hydrophobia, and it is even uncertain whether it has ever been inſtrumental in keeping off that diſorder. Lichen.

16. The aphthoſus, or green ground-liverwort with black warts, grows upon the ground at the roots of trees in woods, and other ſtoney and moſſy places. It differs very little from the foregoing, and according to ſome is only a variety of it. Linnæus informs us, that the country-people of Upland in Sweden give an infuſion of this lichen in milk to children that are troubled with the diſorder called the *thruſh* or *aphthæ*, which induced that ingenious naturaliſt to beſtow upon it the trivial name of *apthoſus*. The ſame writer alſo tells us, that a decoction of it in water purges upwards and downwards, and will deſtroy worms.

17. The cocciferus, or ſcarlet-tipped cup-lichen, is frequent in moors and heaths. It has in the firſt ſtate a granulated cruſt for its ground, which is afterwards turned into ſmall laciniated leaves, green above, and hoary underneath. The plant aſſumes a very different aſpect, according to the age, ſituation, and other accidents of its growth; but may be in general readily diſtinguiſhed by its fructifications, which are fungous tubercles of a fine ſcarlet colour, placed on the rim of the cup, or on the top of the ſtalk. Theſe tubercles, ſteeped in an alcaline lixivium, are ſaid to dye a fine durable red colour.

18. The rangiferinus, or rein-deer lichen, is frequent in woods, heaths, and mountainous places. Its general height, when full grown, is about two inches. The ſtalk is hollow, and very much branched from bottom to top: the branches are divided and ſubdivided, and at laſt terminated by two, three, four, or five very fine, ſhort, nodding horns. The axillæ of the branches are often perforated. The whole plant is of a hoary white or grey colour, covered with white farinaceous particles, light and brittle when dry, ſoft and elaſtic when moiſt. The fructifications are very minute, round, fuſcous, or reddiſh-brown tubercles, which grow on the very extremities of the fineſt branches; but theſe

Lichen ‖ Lichtenfels.

tubercles are very ſeldom found. The plant ſeems to have no foliaceous ground for the baſe, nor ſcarcely any viſible roots.—Linnæus tells us, that in Lapland this moſs grows ſo luxuriant that it is ſometimes found a foot high. There are many varieties of this ſpecies, of which the principal is the ſylvaticus, or brown-tipt rein-deer lichen. The moſt remarkable difference between them is, that the ſylvaticus turns fuſcous by age, while the other always continues white. For the uſes of theſe ſpecies, ſee LAPLAND.

19. The plicatus, or officinal ſtringy lichen, grows on the branches of old trees, but is not very common. The ſtalks are a foot or more in length, cylindrical, rigid, and ſtring-ſhaped, very irregularly branched, the branches entangled together, of a cinereous or aſh-colour, brittle and ſtringy if doubled ſhort, otherwiſe tough and pliant, and hang pendent from the trees on which they grow. The ſhields grow generally at the extremities of the branches, are nearly flat, or ſlightly concave, thin, aſh-coloured above, pale-brown underneath, and radiated with fine rigid fibres. As the plant grows old, the branches become covered with a white, rough, warty cruſt; but the young ones are deſtitute of it. It was formerly uſed in the ſhops as an aſtringent to ſtop hæmorrhagies, and to cure ruptures; but is out of the modern practice. Linnæus informs us, that the Laplanders apply it to their feet to relieve the excoriations occaſioned by much walking.

20. The barbatus, or bearded lichen, grows upon the branches of old trees in thick woods and pine-foreſts. The ſtalks or ſtrings are ſlightly branched and pendulous, from half a foot to two feet in length, little bigger than a taylor's common ſewing thread; cylindrically jointed towards the baſe; but ſurrounded every where elſe with numerous, horizontal, capillary fibres, either ſimple or ſlightly branched. Their colour is a whitiſh green. This has an aſtringent quality like the preceding. When ſteeped in water, it acquires an orange colour; and, according to Dillenius, is uſed in Penſylvania for dyeing that colour.

21. The vulpinus, or gold-wiry lichen, grows upon the trunks of old trees, but is not very common. It is produced in erect tufts, from half an inch to two inches in height, of a fine yellow or lemon-colour, which readily diſcovers it. The filaments which compoſe it are not cylindrical, but a little compreſſed and uneven in the ſurface, variouſly branched, the angles obtuſe, and the branches ſtraggling and entangled one with another. Linnæus informs us, that the inhabitants of Smaland in Sweden dye their yarn of a yellow colour with this lichen; and that the Norwegians deſtroy wolves by ſtuffing dead carcaſes with this moſs reduced to powder, and mixed with pounded glaſs, and ſo expoſing them in the winter-ſeaſon to be devoured by thoſe animals.

LICHFIELD. See LITCHFIELD.

LICHTENBERG, a caſtle of France, in Lower Alſace, and the chief place of a county of the ſame name; ſeated on a rock, near the mountains Voſges, and is looked upon as impregnable. E. Long. 7. 35. N. Lat. 48. 55.

LICHTENBURG, a town of Germany, in the circle of Franconia, and margravate of Cullembach. E. Long. 12. 0. N. Lat. 50. 26.

LICHTENFELS, a town of Germany, in the circle of Franconia, and biſhopric of Bamberg, ſeated on the river Mayne, in E. Long. 11. 10. N. Lat. 50. 20.

Lichtenſtein ‖ Liddel.

LICHTENSTEIN, a town of Swiſſerland, in Tockerberg, ſeated on the river Thour. E. Long. 2. 15. N. Lat. 47. 25.

LICHTSTALL, an handſome town of Swiſſerland, in the county of Baſle; ſeated on the river Ergetz. In E. Long. 7. 57. N. Lat. 47. 40.

LICINIUS STOLO, a famous Roman tribune, ſtyled *Stolo* on account of a law he made, while tribune, that no Roman citizen ſhould poſſeſs more than 500 acres of land; alleging, that when they occupied more, they could not cultivate it with care, nor pull up the uſeleſs ſhoots (*ſtolones*) that grow from the roots of trees. He is memorable alſo for enacting, that one of the conſuls ſhould always be of a Plebeian family. He lived about 362 B. C.

LICNON, in the Dionyſian ſolemnities, the myſtical van of Bacchus; a thing ſo eſſential to all the ſolemnities of this god, that they could not be duly celebrated without it. See DIONYSIA.

LICNOPHORI, in the Dionyſian ſolemnity, thoſe who carried the licnon.

LICOLA, or LAGO-DI-LICOLA, a lake in the kingdom of Naples, formerly famous for plenty of excellent fiſh; but in the year 1538 an exploſion of a volcano changed one part of it into a mountain of aſhes, and the other into a moraſs. It was anciently known by the name of the Lucrine-lake.

LICONIA, in botany: A genus of the digynia order, belonging to the pentandria claſs of plants. There are five petals inlaid in the pit of the nectarium at its baſe; the capſule is bilocular and ſeed-bearing.

LICTORS, among the Romans, were officers eſtabliſhed by Romulus, who always attended the chief magiſtrates when they appeared in public.

The duty of their office conſiſted in the three following particulars: 1. *Submotio*, or clearing the way for the magiſtrate they attended: this they did by word of mouth; or, if there was occaſion, by uſing the rods they always carried along with them. 2. *Animadverſio*, or cauſing the people to pay the uſual reſpect to the magiſtrate, as to alight, if on horſeback or in a chariot; to riſe up, uncover, make way, and the like. 3. *Præitio*, or walking before the magiſtrates: this they did not confuſedly, or altogether, nor by two or three abreaſt, but ſingly following one another in a ſtraight line. They alſo preceded the triumphal car in public triumphs; and it was alſo part of their office to arreſt criminals, and to be public executioners in beheading, &c. Their enſigns were the FASCES and SECURIS.

As to the number of lictors allowed each magiſtrate, a dictator had twenty-four, a maſter of the horſe ſix, a conſul twelve, a prætor ſix; and each veſtal virgin, when ſhe appeared abroad, had one.

LIDD. See LYDD.

LIDDEL (Dr Duncan), profeſſor of mathematics and of medicine in the univerſity of Helmſtadt, was born in the year 1561 at Aberdeen, where he received the firſt part of his education in languages and philoſophy. About the age of eighteen he repaired to the univerſity of Francfort, where he ſpent three years in a diligent application to mathematics and philoſophy. From Francfort he proceeded to Wratiſlaw, or Breſlaw, in Sileſia, where he

Liddel. he is ſaid to have made uncommon progreſs in his favourite ſtudy of mathematics, under the direction of a very eminent profeſſor, Paulus Wittichius. Having ſtudied at Breſlaw for the ſpace of one year, he returned to Francfort, and remained there three years, paying the moſt intenſe application to the ſtudy of phyſic. A contagious diſtemper having broke out at that place, the ſtudents were diſperſed, and Liddel retired to the univerſity of Roſtock. Here he renewed his ſtudies, rather as a companion than as a pupil of the celebrated Brucæus, who, though an excellent mathematician, did not ſcruple to confeſs that he was inſtructed by Liddel in the more perfect knowledge of the Copernican ſyſtem, and other aſtronomical queſtions. In 1590 he returned once more to Francfort. But having there heard of the increaſing reputation of the Academia Julia, eſtabliſhed at Helmſtadt by Henry duke of Brunſwick, Mr Liddel removed thither; and ſoon after his arrival was appointed to the firſt or lower profeſſorſhip of mathematics. From thence he was promoted to the ſecond and more dignified mathematical chair, which he occupied for nine years, with much credit to himſelf and to the Julian Academy. In 1596 he obtained the degree of M. D. was admitted a member of that faculty, and began publicly to teach phyſic. By his teaching and his writings he was the chief ſupport of the medical ſchool at Helmſtadt; was employed as firſt phyſician at the court of Brunſwick, and had much practice among the principal inhabitants of that country. Having been ſeveral times elected dean of the faculties both of philoſophy and phyſic, he had in the year 1604 the honour of being choſen prorector of the univerſity. But neither academical honours, nor the profits of an extenſive practice abroad, could make Dr Liddel forget his native country. In the year 1600 he took a final leave of the Academia Julia; and after travelling for ſome time through Germany and Italy, he at length ſettled in Scotland. He died in the year 1613, in the fifty-ſecond year of his age. By his laſt will he beſtowed certain lands purchaſed by him near Aberdeen upon the univerſity there, in all time coming, for the education and ſupport of ſix poor ſcholars. Among a variety of regulations and injunctions for the management of this charity, he appoints the magiſtrates of Aberdeen his truſtees, and ſolemnly denounces the curſe of God on any perſon who ſhall abuſe or miſapply it. His works are, 1. *Diſputationes Medicinales, Helmſtadt*, 1603, 4to. 2. *Ars Medica ſuccincte et perſpicue explicata, Hamburghi*, 1607, 8vo. This performance is dedicated to king James VI. and is divided into five books, viz. *Introductio in totam Medicinam; De Phyſiologia; De Pathologia; De Signonem doctrina; De Therapeutica.* 3. *De Febribus Libri tres, Hamburghi*, 1610, 12mo. 4. *Tractatus de dente aureo, Hamburghi*, 1628, 12mo. This laſt performance Dr Liddel publiſhed in order to refute a ridiculous ſtory then current of a poor boy in Sileſia, who, at ſeven years of age, having loſt ſome of his teeth, brought forth, to the aſtoniſhment of his parents, a new tooth of pure gold. Jacobus Horſtius, doctor and profeſſor of medicine in the *Academia Julia*, at the ſame time with our author, had publiſhed a book, which he dedicated to the Emperor Rudolphus II. to prove that this wonderful tooth was a prodigy ſent from heaven to encourage the Germans then at war with the Turks, and foretelling, from this golden tooth, the future victories of the Chriſtians, with the final deſtruction of the Turkiſh empire and Mahometan faith, and a return of the golden age in 1700, preparatory to the end of the world. The impoſture was ſoon after diſcovered to be a thin plate of gold, ſkilfully drawn over the natural tooth by an artiſt of that country, with a view to excite the public admiration and charity. 5. *Artis conſervandi Sanitatem, libri duo, Aberdoniæ*, 1651, 12mo.; a poſthumous work. The merit of theſe works of Dr Liddel, it is not now neceſſary to eſtimate with preciſion. They appear, however, to contain the moſt faſhionable opinions and practice, in the medical art, of the age in which he lived; nor is there almoſt any diſeaſe or medical ſubject then known of which he has not treated in one or other of his writings. Of his language it may be ſufficient to obſerve, that the Latin is at leaſt as pure as is generally found among medical writers, and that his ſtyle is plain and perſpicuous, and ſometimes even elegant.

Lidford ‖ Lie.

LIDFORD, a village of Devonſhire in England, ſituated on the river Lid, two or three miles eaſt of Brent Tor, was formerly a famous town, with a caſtle, which was always committed to men of quality, and twice ſent burgeſſes to parliament. It was ſadly ſhattered by the Danes in 997: and though now a contemptible village, the pariſh may for lands and liberties compare with any in the kingdom, the whole foreſt of Dartmore being in the verge of it. The river here being pent up at the bridge with rocks, has made itſelf ſo deep a fall, by its continual working, that paſſengers only hear the noiſe of the water without ſeeing it.

LIDKOPING, a town of Weſt Gothland in Sweden, ſeated on the lake Wenar, in E. Long. 13. 40. N. Lat. 58. 25.

LIDNEY, a town of Glouceſterſhire in England, 71 miles from London, is ſeated on the weſt bank of the river Severn, and has a market on Wedneſdays, with two fairs in the year. In the neighbourhood are the remains of a large Roman encampment, with foundations of many ancient buildings, among which are the ruins of a Roman hypocauſt of an oval form, and Roman antiquities and coins are often found here in great number. Mr Bathurſt has a fine ſeat here called *Sydney-Park*, with very extenſive woods adjoining.

LIE, in morals, denotes a criminal breach of veracity.—Archdeacon Paley, in treating of this ſubject, obſerves, that there are falſehoods which are not lies; that is, which are not criminal: and there are lies which are not literally and directly falſe.

I. Caſes of the firſt claſs are thoſe, 1. Where no one is deceived: as for inſtance in parables, fables, novels, jeſts, tales to create mirth, or ludicrous embelliſhments of a ſtory, in which the declared deſign of the ſpeaker is not to inform, but to divert; compliments in the ſubſcription of a letter; a priſoner's pleading not guilty; an advocate aſſerting the juſtice, or his belief of the juſtice, of his client's cauſe. In ſuch inſtances no confidence is deſtroyed, becauſe none was repoſed; no promiſe to ſpeak the truth is violated, becauſe none was given or underſtood to be given. 2. Where the perſon you ſpeak to has no right to know the truth, or more properly where little or no inconveniency reſults from the want of confidence in ſuch caſes; as where you tell a falſehood to a madman for his own advantage; to a robber to conceal your property; to an aſſaſſin to defeat or to divert him from his purpoſe. It is upon this principle, that, by the laws of war, it is allowed to deceive an enemy by feints, falſe colours,

Lie ‖ Liege.

ſpies, falſe intelligence, and the like: but, by no means, in treaties, truces, ſignals of capitulation, or ſurrender: and the difference is, that the former ſuppoſe hoſtilities to continue, the latter are calculated to terminate or ſuſpend them.

Many people indulge in ſerious diſcourſe a habit of fiction and exaggeration, in the accounts they give of themſelves, of their acquaintance, or of the extraordinary things which they have ſeen or heard; and ſo long as the facts they relate are indifferent, and their narratives though falſe are inoffenſive, it may ſeem a ſuperſtitious regard to truth to cenſure them merely for truth's ſake. Yet the practice ought to be checked: for, in the firſt place, it is almoſt impoſſible to pronounce beforehand, with certainty, concerning any lie, that it is inoffenſive; or to ſay what ill conſequences may reſult from a lie apparently inoffenſive: And, in the next place, the habit, when once formed, is eaſily extended to ſerve the deſigns of malice or intereſt; like all habits, it ſpreads indeed of itſelf. Pious frauds, as they are improperly enough called, pretended inſpirations, forged books, counterfeit miracles, are impoſitions of a more ſerious nature. It is poſſible that they may ſometimes, though ſeldom, have been ſet up and encouraged with a deſign to do good: but the good they aim at requires, that the belief of them ſhould be perpetual, which is hardly poſſible; and the detection of the fraud is ſure to diſparage the credit of all pretenſions of the ſame nature. Chriſtianity has ſuffered more injury from this cauſe than from all other cauſes put together.

II. As there may be falſehoods which are not lies, ſo there may be lies without literal or direct falſehood. An opening is always left for this ſpecies of prevarication, when the literal and grammatical ſignification of a ſentence is different from the popular and cuſtomary meaning. It is the wilful deceit that makes the lie; and we wilfully deceive, when our expreſſions are not true, in the ſenſe in which we believe the hearer apprehends them. Beſides, it is abſurd to contend for any ſenſe of words, in oppoſition to uſage; for all ſenſes of all words are founded upon uſage, and upon nothing elſe. Or a man may act a lie; as by pointing his finger in a wrong direction, when a traveller inquires of him his road; or when a tradeſman ſhuts up his windows, to induce his creditors to believe that he is abroad: for to all moral purpoſes, and therefore as to veracity, ſpeech and action are the ſame; ſpeech being only a mode of action.

LIECHTENAU, a town of Germany, in the circle of Franconia and margravate of Anſpach, ſubject to Nurenburg. E. Long. 9. 5. N. Lat. 48. 43.

LIEGE (*Ligius*,) in law, properly ſignifies a vaſſal, who holds a kind of fee, that binds him in a cloſer obligation to his lord than other people.

The term ſeems to be derived from the French *lier* "to bind;" on account of a ceremony uſed in rendering faith or homage: which was by locking the vaſſal's thumb or his hand in that of the lord, to ſhow that he was faſt bound by his oath of fidelity. Cujas, Vigenere, and Bignon, chooſe rather to derive the word from the ſame ſource with *leudis* or *leodi*, "loyal, faithful." But Du Cange falls in with the opinion of thoſe who derive it from *liti*, a kind of vaſſals, ſo firmly attached to their lord, on account of lands or fees held of him, that they were obliged to do him all manner of ſervice, as if they were his domeſtics. He adds, this was formerly called *litgium ſervitium*, and the perſon *litge*. In this ſenſe, the word is uſed, Leg. Edw. cap. 29. *Judæi ſub tutela regis ligea debent eſſe*; that is, wholly under his protection. Liege.

By liege homage, the vaſſal was obliged to ſerve his lord towards all, and againſt all, excepting his father. In which ſenſe, the word was uſed in oppoſition to ſimple homage; which laſt only obliged the vaſſal to pay the rights and accuſtomed dues to his lord; and not to bear arms againſt the emperor, prince, or other ſuperior lord: ſo that a liege man was a perſon wholly devoted to his lord, and entirely under his command. *Omnibus, &c. Reginaldus, rex Inſularum, ſalutem. Sciatis quod deveni homo ligeus domini regis Angliæ Johannis, contra omnes mortales, quamdiu vixero; & inde ei fidelitatem & ſacramentum præſtiti, &c.* MS. penes W. Dugdale.

But it muſt be obſerved, there were formerly two kinds of liege homage: the one, by which the vaſſal was obliged to ſerve his lord, againſt all, without exception even of his ſovereign; the other, by which he was to ſerve him againſt all, except ſuch other lords as he had formerly owed liege homage to.

In our old ſtatutes lieges, and liege people, are terms peculiarly appropriated to the king's ſubjects; as being *liges*, *ligi*, or *ligati*, obliged to pay allegiance to him; 8 Henry VI. 14 Hen. VIII. &c. though private perſons had their lieges too. *Reinaldus, Dei gratia, abbas Rameſiæ, præpoſito & hominibus de Brance ſtre, & omnibus vicinis Francis & Anglis, ſalutem. Sciatis me dediſſe terram Ulfe, in depedene (hodie depedale) huic Boſelino, & uxori ejus Alfniæ—ea conditione quod effecti ſint homines leges.* Lib. Rameſ.

Liege-Pouſtie, in Scots law, is oppoſed to deathbed; and ſignifies a perſon's enjoying that ſtate of health in which only he can diſpoſe of his property at pleaſure.

LIEGE, a biſhopric of Germany, in the circle of Weſtphalia; bounded to the north by Brabant, to the ſouth by Champagne and Luxemberg, to the eaſt by Limburg and Juliers, and to the weſt by Brabant, Namur, and Hainault. It is very unequal both in length and breadth; the former being in ſome places above 90 miles, in others not half ſo much; and the latter in ſome places 45, in others hardly 25. The air here is very temperate; and the ſoil fruitful in corn, wine, wood, and paſture. Here alſo are mines of lead and iron, pits of coal, quarries of marble and ſtone, and ſome celebrated mineral waters, as thoſe of Spa and Chau-fontaine. The principal rivers are, the Maes and Sambre. The manufactures and commodities of the country are chiefly beer, arms, nails, ſerge, leather, with the products we have juſt mentioned. The ſtates of the biſhopric are compoſed of three bodies: the firſt is the chapter of Liege; the ſecond, the nobility of the country; and the third, the deputies of the capital and the other towns. The three eſtates are ſeldom called together, except to raiſe taxes for the ſervice of the province, or upon ſome particular emergency; but there is a committee of the ſtates, who meet thrice a-week, and in time of war daily. They are always about the prince-biſhop, to make remonſtrances, and demand the redreſs of grievances. The biſhop is ſpiritual and temporal lord of

Liege. of the whole country; but, as biſhop, is ſuffragan to the archbiſhop of Cologne. He ſtyles himſelf, *by the grace of God, biſhop and prince of Liege, duke of Bouillon, marquis of Franchimont, count of Looz, Hoorn*, &c. His arms for Liege are, a pillar argent, on a pedeſtal of the ſame, with a crown or, in a field ruby. In the matricula he was formerly rated at 50 horſe and 170 foot; or 1280 florins monthly, in lieu of them, but now only at 826. An abatement of one third has alſo been granted of the ancient aſſeſſment to the chamber-court, which was 360 rix-dollars 62½ kruitzers for each term. Here are ſeveral colleges which ſit at Liege, for the government of the country, and the deciſion of cauſes, civil, criminal, ſpiritual, and feudal, and of ſuch alſo as relate to the finances. The chapter conſiſts of 60 perſons, who muſt either prove their nobility for four generations, both by father and mother, before they can be admitted: or if they cannot do that, muſt at leaſt have been doctors or, licentiates of divinity for ſeven years, or, of law, for five years, in ſome famous univerſity. The biſhopric is very populous and extenſive, containing 1500 pariſhes, in which are 24 walled towns, beſides others, 52 baronies, beſides counties and ſeigniories, 17 abbeys for men, who muſt be all gentlemen, and 11 for ladies, excluſive of others.

Liege, the capital of the biſhopric of the ſame name, ſtands upon the Maes, in a fine valley, ſurrounded with woods and hills, being a free imperial city, and one of the largeſt and moſt eminent in Europe. Though it is 100 miles from the ſea by water, the Maes is navigable up to it. The city has 16 gates; 17 bridges, ſome of them very handſome; 154 ſtreets, many of them ſtraight and broad; a fine epiſcopal palace; a very large ſtately cathedral, in which, beſides five great ſilver coffers full of reliques, are ſeveral ſilver ſtatues of ſaints, and a St George on horſeback of maſſy gold, preſented to the cathedral by Charles the Bold, by way of atonement for uſing the inhabitants cruelly in the year 1468. Of the other churches, that of St Paul is the moſt remarkable, both for its ſtructure and fine ornaments in painting and marble. The city is well fortified, and there are alſo two caſtles on the mountain of the Holy Walburg for its defence. Beſides a great number of other convents of both ſexes, here is a college of Engliſh Jeſuits, founded in the year 1616, and a fine nunnery of Engliſh ladies. Indeed, churches, convents, and other religious foundations, take up the greater part of it. The reader, therefore, no doubt, will take it for granted, that it is a moſt bleſſed, holy, and happy city. But however it may fare with the profane, unhallowed laity, it is certainly the paradiſe of prieſts, as it is expreſsly called, by way of eminence. It is divided into the old and new, or the upper and lower; and the latter again into the iſland, and the quarter beyond the Maes. The houſes are high, and built of bluiſh marble. In the town and ſuburbs are 12 public places or ſquares, 10 hoſpitals, a beguin-houſe, and two fine keys, planted with ſeveral rows of trees, for the burghers to take the air; but a great part of that within the walls is taken up with orchards and vineyards. The manufactures of this city are arms, nails, leather, ſerge, and beer. In St William's convent, without the city, is the tomb of the famous Engliſh traveller Sir John Mandeville, with an inſcription in barbarous French, requeſting thoſe who read it to pray for his ſoul. Near it are kept the ſaddle, ſpurs, and knife, that he made uſe of in his travels. After having ſeen moſt of the cities of any note in the world, he made choice of this to ſpend the eve of his life in. A little way from the city, on the other ſide the Maes, ſtands the epiſcopal palace of Seraing, in which the biſhops generally reſide during the ſummer. The latitude of this city is 50. 36. N. and the longitbde 5. 40. E. Liege.

Some diſturbances took place here in the year 1789, in conſequence of certain diſputes that had ariſen between the prince-biſhop and the inhabitants. The latter having demanded certain privileges, which he did not think proper to grant, they took up arms, and compelled him and his chapter to comply with their requeſt. The prince, together with many of the clergy, nobility, and citizens, alarmed by this commotion, and dreading the conſequences of popular fury, which when once rouſed, ſeldom knows any bounds, ſought ſafety by a voluntary exile. They then appealed to the imperial chamber; and this tribunal, inſtead of acting the part of arbiter, decided as a ſovereign, and ordered the circles of the Lower Rhine and Weſtphalia to execute the ſentence.

The king of Pruſſia, at whoſe court one of the chiefs of the inſurrection had reſided, and who wiſhed to gain a party at Liege, became mediator; and ſeemed to favour the Liegoiſe, many of whoſe claims were juſt, though they attempted to enforce them by violence and the moſt illegal ſteps. Intoxicated with this protection, the people of Liege treated the remonſtrances of their biſhop, the decrees of the imperial chamber, and the reſolutions of the directory of the two circles, with the utmoſt contempt; and proceeded ſo far as even to dethrone their prince, by appointing a regent in the perſon of a French prelate. The electoral college having deliberated on the beſt means of putting an end to theſe diſturbances, its propoſitions, though modified by M. Dohm the Pruſſian plenipotentiary, made the inſurgents break out into open ſedition. Deluded by their leaders, they gave themſelves up every day to new exceſſes; the effects of the citizens were expoſed to pillage, and their perſons to inſult. The king of Pruſſia, who was deſirous to bring matters to an accommodation, and not to inſtigate the Liegoiſe to become independent, finding that the efforts of his miniſter were not attended with the deſired ſucceſs, ſeemeed unwilling to interfere any farther in an affair which might have led him into a quarrel with the empire. The executive troops, at the ſame time, remained almoſt in a ſtate of inactivity; and ſeemed rather to guard the frontiers of this petty ſtate, than to make any attempt to reduce it to obedience. Neither this conduct, however, nor the exhortations of Pruſſia, added to the moral certainty of their being ſoon compelled to lay down their arms, made any change in the conduct of the malecontents. They declared openly, in the face of all Europe, that they would either conquer or die; and they perſiſted in this reſolution, while commerce, manufactures, and the public revenues, were going daily to decay.

Having at length openly attacked the executive forces without the territories of their city, the emperor could no longer remain an indifferent ſpectator. It

Liege, Lievens.

was now full time to put a period to that madneſs to which the people had abandoned themſelves; and to accompliſh this in an effectual manner, the imperial chamber at Wetzlar requeſted the emperor, as a member of the ancient circle of Burgundy, to execute its orders reſpecting this object. In conſequence of this meaſure, Baron Alvinzi, who commanded a body of Auſtrians cantoned in Limburgh and the confines of Brabant, notified, by order of Marſhal Bender, to the ſtates and municipality of Liege, that the emperor intended to ſend troops into their city and territories, for the purpoſe of reſtoring tranquillity and good order. The ſtates had already been informed of this reſolution by their agent at Wetzlar. They therefore wrote to Marſhal Bender, to aſſure him of the reſpectful confidence which they placed in the juſtice and magnanimity of the emperor, and to requeſt that the Auſtrian troops might enter alone, without thoſe of the electors; and that they might be confined to occupy the gates and the ſuburbs only. To this letter, which was carried to Bruſſels by a deputation of the ſtates, Marſhal Bender returned a very ſatisfactory anſwer, relating to the diſpoſition of the electoral troops: but Baron Alvinzi, in a note which he wrote to the ſtates, inſiſted among other articles, that all the citizens ſhould throw down their arms; that proper accommodations ſhould be prepared for the officers and men; that the warlike ſtores, collected for making reſiſtance, ſhould be removed; and that cockades, and every other diſtinctive mark of the like kind, ſhould be laid aſide before the arrival of the Imperial troops. However humiliating theſe preliminaries might be, eſpecially that of a general diſarming, the ſtates and municipalities acquieſced without the leaſt reſerve; and their ſubmiſſion, as ſudden as complete, was communicated to the people, with an exhortation to follow their example.

Notwithſtanding this pacific appearance, two days before the entrance of the Imperial troops, the municipal council of Liege, flattering themſelves, perhaps, with the hopes of aſſiſtance from Pruſſia, aſſured the inhabitants that they would remain unſhaken in their poſt, and that they had ſworn never to deſert the cauſe in which they were engaged. This, however, did not prevent the Auſtrian troops, to the number of 6000, from penetrating, without oppoſition, into the heart of the city; where they occupied every poſt; made the citizens lay aſide their arms, uniforms, and cockades; and, in a ſingle hour, dethroned ſo many ſovereigns of a year. The greater part of the municipal officers, who, two days before, had ſolemnly promiſed ſuch great things, betook themſelves to flight, and retired either to France or Weſel; while the ancient magiſtracy, which had been expelled in the month of Auguſt 1789, was proviſionally re-inſtated by the directorial commiſſioners.—The decrees of the imperial chamber at Wetzlar have ſince been executed in their utmoſt extent. The ancient magiſtracy and the privy-council of the prince biſhop have been reſtored; and the prince himſelf having returned, peace and good order have been re-eſtabliſhed.

LIENTERY, a flux of the belly, in which the aliments are diſcharged as they are ſwallowed, or very little altered either in colour or ſubſtance. See *(Index* ſubjoined to) MEDICINE.

LIEVENS (John or Jan), a celebrated painter, was born at Leyden in 1607. He diſcovered an early inclination for the arts, and was the diſciple firſt of Joris van Schooten, and afterwards of Peter Laſtman. He excelled principally in painting portraits; but he alſo executed ſeveral hiſtorical ſubjects with great ſucceſs. He came over into England, where he reſided three years, and painted the portraits of Charles I. the queen, the prince of Wales, and ſeveral of the nobility; after which he returned to Antwerp, where he met with full employment for his pencil. We have ſeveral etchings by this maſter, which are performed in a ſlight, but maſterly manner. The chiaro ſcuro is very ſkilfully managed in them, ſo as to produce a moſt powerful effect. His ſtyle of etching bears ſome reſemblance to that of Rembrandt; but it is coarſer in general, and leſs finiſhed.

Lieou-Kieou.

LIEOU-KIEOU, the name of certain iſlands of Aſia, ſubject to China; but hitherto little known to geographers, who have been ſatisfied with marking their exiſtence and latitude in their charts. They, however, form a powerful and extenſive empire, the inhabitants of which are civilized, and ought not to be confounded with other ſavage nations diſperſed throughout the iſlands of Aſia. Father Gabil, a Jeſuit, has furniſhed us with ſome intereſting details reſpecting theſe iſlanders, which he extracted from a Chineſe relation, publiſhed in 1721, at the end of a voyage that was undertaken on the following account. The emperor Kang-hi having reſolved, in 1719, to ſend an ambaſſador to the king of Lieou-kieou, choſe for this purpoſe one of the great doctors of the empire, named *Supao-Koang*. This learned man departed from China in 1719, and returned to Peking in 1720, where, in the year following, he cauſed a relation of his voyage to be publiſhed in two volumes. It is in the firſt of theſe that he gives an accurate and particular deſcription of the iſles of Lieou-kieou; and what he relates appears to be worthy of the greater credit, becauſe, being on the ſpot, he examined, as he himſelf ſays, according to the orders of the emperor, whatever he found curious or intereſting, reſpecting the number, ſituation, and productions of theſe iſles; as alſo the hiſtory, religion, manners, and cuſtoms of the people who inhabit them.

Theſe iſles, ſituated between Corea, Formoſa, and Japan, are in number 36. The principal and largeſt is called *Lieou-kieou;* the reſt have each a particular denomination. The largeſt iſland extends from north to ſouth almoſt 440 lys, and 120 or 130 from eaſt to weſt; but on the ſouth ſide, the extent from eaſt to weſt is not 100 lys. The ſouth-eaſt part of the iſland, where the court reſides, is called *Cheouli;* and it is there that Kint-ching, the capital city, is ſituated. The king's palace, which is reckoned to be four leagues in circumference, is built on a neighbouring mountain. It has four gates, which correſpond to the four cardinal points; and that which fronts the weſt forms the grand entry. The view which this palace commands is moſt extenſive and delightful; it reaches as far as the port of Napakiang, at the diſtance of ten lys, to the city of Kint-ching, and to a great number of other cities, towns, villages, palaces, temples, monaſteries, gardens, and pleaſure-houſes. It ſtands in longitude 146° 26′ eaſt, and in latitude 26 2′ north.

If we believe theſe iſlanders, the origin of their em-

Lieou-Kieou.

pire is loſt in the remoteſt antiquity. They reckon up 25 ſucceſſive dynaſties, the duration of which forms a period of more than 18,000 years. It would be uſeleſs to employ a ſingle moment in pointing out the abſurdity of theſe pretenſions. It is however certain, that the exiſtence of the country called *Lieou-kieou* was not known in China before the year 605 of the Chriſtian æra. It was in the courſe of that year, that one of the emperors of the dynaſty of Soui, having heard of theſe iſles, was deſirous of knowing their ſituation. This prince at firſt ſent ſome Chineſe thither; but their expedition proved fruitleſs, as the want of interpreters prevented them from acquiring that knowledge which was the object of their voyage. They only brought ſome of the iſlanders with them to Sigan-fou, the capital of the province of Chen-ſi, which was the uſual reſidence of the emperors of the dynaſty of Soui. It fortunately happened, that an embaſſador of the king of Japan was then at court. This ambaſſador and his attendants immediately knew the ſtrangers to be natives of Lieou-kieou; but they ſpoke of theſe iſles as of a miſerable and wretched country, the inhabitants of which had never been civilized. The emperor of China afterwards learned, that the principal iſland lay to the eaſt of a city called at preſent *Fou-tcheou-fou*, which is the capital of the province of Fo-kien; and that, in a paſſage of five days, one might reach the large iſland where the king kept his court.

On this information, the emperor Yang-ti ſent ſkilful men, accompanied by interpreters, to ſummon the prince to do homage to the emperor of China, and to pay him tribute. This propoſal was very ill received. The king of Lieou-kieou ſent back the Chineſe, telling them, ſternly, that he acknowledged no prince to be his ſuperior. This anſwer irritated the emperor, who, to obtain revenge, cauſed a fleet to be immediately equipped in Fo-kien, in which he embarked 10,000 men. This fleet ſet ſail, and arrived in ſafety at the port of Napa-kiang. The army, in ſpite of every effort made by the natives, landed on the iſland; and the king, who had put himſelf at the head of his troops to oppoſe the enemy, having fallen in battle, the Chineſe pillaged, ſacked, and burnt the royal city, made more than 5000 ſlaves, and returned to China.

The emperors of the dynaſty of Tang, thoſe of the ſhort dynaſties that followed, and thoſe of the dynaſty of Song, although they were fully informed of every thing reſpecting the Lieou-kieou iſles, made no attempts to render them tributary. In 1291, Chi-tſou, emperor of the dynaſty of Yven, was deſirous of reviving the pretenſions of his predeceſſors. He fitted out a fleet to ſubdue theſe iſlands; but ſchemes of conqueſt had become diſagreeable to the Chineſe, ſince the diſaſter that befel their army in an expedition againſt Japan. The fleet of Chi-tſou went no farther than the iſles of Pong-hou, and the weſtern coaſt of Formoſa, from whence, under divers pretences, they returned to the ports of Fo-kien.

It was only in 1372, under the reign of Hong-vou, founder of the dynaſty of Ming, that theſe iſlands ſubmitted voluntarily to the Chineſe government. Hong-vou had ſent one of the grandees of his court to Tſay-tou, who was then reigning at Lieou-kieou, to inform him of his acceſſion to the throne. The Chineſe nobleman had received particular inſtructions reſpecting this commiſſion, and he acquitted himſelf of it with all the prudence and addreſs of an able miniſter. In a private audience which he had with Tſay-tou, he exhorted this prince to declare himſelf a tributary of the empire, and laid before him the advantages he would derive from this ſtep. His reaſoning, ſupported by the power of his natural eloquence, made ſo much impreſſion on the mind of Tſay-tou, that he embraced the propoſal made him, and ſent immediately to the emperor to demand the inveſtiture of his ſtates.

Hong-vou received his envoys in a magnificent manner, and loaded them with preſents. He ſolemnly declared Tſay-tou a vaſſal of the empire; and, after having received his firſt tribute (which conſiſted in valuable horſes, aromatic wood, ſulphur, copper, tin, &c.) he ſent to this prince a golden ſeal, and confirmed the choice he had made of one of his ſons for ſucceſſor. The emperor afterwards ſent 36 families, almoſt all from the province of Fo-kien to Lieou-kieou. Tſay-tou received them, aſſigned them lands near the port of Napa-kiang, and appointed certain revenues for their uſe, at the ſame time that Hong-vou made them conſiderable remittances. Theſe families firſt introduced into Lieou-kieou the learned language of the Chineſe, the uſe of their characters, and the ceremonies practiſed in China in honour of Confucius. On the other hand, the ſons of ſeveral of the grandees of the court of Tſay-tou were ſent to Nan-king, to ſtudy Chineſe in the imperial college, where they were treated with diſtinction, and maintained at the emperor's expences.

The iſles of Lieou-kieou had neither iron nor porcelain. Hong-vou ſupplied this want; he cauſed a great number of utenſils of iron and inſtruments to be made, which he ſent thither, together with a quantity of porcelain veſſels. Commerce, navigation, and the arts ſoon began to flouriſh. Theſe iſlanders learned to caſt bells for their temples, to manufacture paper and the fineſt ſtuffs, and to make porcelain, with which they had been ſupplied before from Japan.

The celebrated revolution which placed the Tartars on the imperial throne of China, produced no change in the conduct of the kings of Lieou-kieou. Chang-tché, who was then reigning, ſent embaſſadors to acknowledge Chun-tchi, and received a ſeal from him, on which were engraven ſome Tartar characters. It was then ſettled, that the king of Lieou-kieou ſhould pay his tribute only every two years, and that the number of perſons in the train of his envoys ſhould not exceed 150.

The emperor Kang-hi ſeemed to pay more attention to theſe iſles than any of his predeceſſors. He cauſed a ſuperb palace to be erected in honour of Confucius, and a college where he maintained maſters to teach the ſciences and the Chineſe characters. He alſo inſtituted examinations for the different degrees of the literati. He ordained, that the king of Lieou-kieou ſhould never ſend in tribute roſe-wood, cloves, or any other production which was not really of the growth of the country; but that he ſhould ſend a fixed quantity of ſulphur, copper, tin, ſhells, and mother of pearl, which is remarkably pretty in theſe iſlands. He permitted, that, beſides the uſual tribute, he might preſent him horſe-furniture, piſtol-caſes, and other things of the ſame kind, which theſe iſlanders are ſaid to manufacture with great taſte and neatneſs.

Lieou-Kieou.

It is more than 900 years ſince the bonzes of China introduced at Lieou-kieou the worſhip of Fo, and the principal books belonging to their ſect. This worſhip is at preſent the eſtabliſhed religion both of the grandees and of the people. There is ſtill to be ſeen in the royal city a magnificent temple, erected in honour of another idol borrowed from the Chineſe, named *Tein-fey*, which ſignifies *celeſtial queen* or *lady*.

Theſe iſlanders do not make promiſes or ſwear before their idols. When they have occaſion to do this, they burn perfumes, preſent fruits, and ſtand reſpectfully before ſome ſtone, which they call to witneſs the ſolemnity of their engagements. Numbers of ſtones are to be ſeen in the courts of their temples, in moſt public places, and upon their mountains, which are entirely appropriated to this purpoſe. They have alſo among them women conſecrated for the worſhip of ſpirits, who are ſuppoſed to have great influence over theſe beings. They viſit the ſick, diſtribute medicines, and recite prayers for their recovery.

They reſpect the dead as much as the Chineſe, and they are no leſs ceremonious in wearing mourning; but their funerals are neither ſo pompous, nor attended with ſo much expence. Their coffins, which are of an hexagonal or octagonal figure, are three or four feet high. They burn the fleſh of the bodies of their dead, and preſerve only the bones. They never offer proviſions to them; they are contented with placing lamps round them, and burning perfumes.

Different families are diſtinguiſhed in Lieou-kieou by ſurnames, as in China; but a man and a woman of the ſame ſurname cannot be united in marriage. The king is not permitted to marry but in the three grand families, which always enjoy the higheſt offices. There is a fourth, of equal diſtinction to the three former; but neither the king nor the princes contract any alliances with this family; for it is doubtful, whether it be not ſprung from the ſame ſtem as the royal line.

A plurality of wives is allowed in theſe iſles. Young men and young women enjoy the liberty of ſeeing one another, and of converſing together; and their union is always in conſequence of their own choice. The women are very reſerved; they never uſe paint, and wear no pendants in their ears; they collect their hair on the top of their heads in the form of a curl, and fix it in that manner by means of long pins made of gold or ſilver.

Beſides the vaſt domains which the king poſſeſſes, he receives the produce of all the ſulphur, copper, and tin-mines, and of the ſalt-pits, together with what ariſes from taxes. From theſe revenues he pays the ſalaries of the mandarins and officers of his court. Theſe ſalaries are eſtimated at a certain number of ſacks of rice; but under this name is comprehended whatever the king gives in grain, rice, ſilk, cloth, &c. The whole is valued according to the price of the ſacks of rice.

There are here, as in China, nine orders of mandarins, who are diſtinguiſhed by the colour of their caps, or by their girdles and cuſhions. The greater part of the titles of theſe mandarins are hereditary in their families; but there are ſome which are only beſtowed upon merit. In the royal city there are tribunals eſtabliſhed for managing the revenue and affairs of the principal iſland, and of all the others which are dependent on it. The latter have agents, who reſide at court. There are alſo particular tribunals for civil and criminal matters; for whatever concerns the families of the grandees and princes; for the affairs of religion; for inſpecting the public granaries, king's revenues, duties; for commerce, manufactures, civil ceremonies, and for navigation, public edifices, literature, and war.

Lieutaud, Lieutenant.

The veſſels that are built in this country are greatly valued by the people of China and Japan. In theſe the natives go not only from one iſland to another, but alſo to China, Tong-king, Cochinchina, Corea, Nangaza-ki, Satſuma, the neighbouring iſles, and to Formoſa, where they diſpoſe of their different commodities. Beſides thoſe articles of commerce which their manufacturies of ſilk, cotton, paper, arms, copper utenſils, &c. furniſh them, they alſo export mother of pearl, tortoiſe and other ſhells, coral and whet-ſtones, which are in great requeſt both in China and Japan.

LIEUTAUD (Dr Joſeph), counſellor of ſtate and firſt phyſician at the court of France, was born at Aix in Provence, and reſided principally there till he took the degree of doctor of medicine. After this he proſecuted his ſtudies for ſome years at Montpelier. He returned to Aix, where he ſoon acquired extenſive practice, and became eminent for literary abilities. He reſided there till the year 1750, when he was invited to act as phyſician to the royal infirmary at Verſailles. There he practiſed with ſuch reputation and ſucceſs, that he ſoon arrived at the head of his profeſſion; and in the year 1774, upon the death of M. Senac, he was appointed archiater. His extenſive engagements in practice did not prevent him from cultivating the ſcience of medicine in all its branches, and from freely communicating to others the reſult of his own ſtudies. He publiſhed many valuable works; amongſt which the following may be accounted the moſt remarkable. 1. *Elementa Philologiæ.* 2. *Precis de la Medecine.* 3. *Pratique Precis de la Matiere Medicale.* 4. *Eſſais Anatomique.* 5. *Synopſis Univerſæ Praxeos Medicinæ.* 6. *Hiſtoria Anatomico-Medica.* He died at Verſailles in 1780, aged 78 years.

LIEUTENANT, an officer who ſupplies the place and diſcharges the office of a ſuperior in his abſence. Of theſe, ſome are civil, as the lords lieutenants of kingdoms, and the lords-lieutenants of counties; and others are military, as the lieutenant-general, lieutenant-colonel, &c.

Lord LIEUTENANT *of Ireland*, is properly a viceroy; and has all the ſtate and grandeur of a king of England, except being ſerved upon the knee. He has the power of making war and peace, of beſtowing all the offices under the government, of dubbing knights, and of pardoning all crimes except high treaſon; he alſo calls and prorogues the parliament, but no bill can paſs without the royal aſſent. He is aſſiſted in his government by a privy-council; and, on his leaving the kingdom, he appoints the lords of the regency, who govern in his abſence.

Lord LIEUTENANTS *of Counties*, are officers, who, upon any invaſion or rebellion, have power to raiſe the militia, and to give commiſſions to colonels and other officers, to arm and form them into regiments, troops, and companies. Under the lord-lieutenants, are deputy-lieutenants, who have the ſame power;

Lieutenant. theſe are choſen by the lords-lieutenants, out of the principal gentlemen of each county, and preſented to the king for his approbation.

Lieutenant-Colonel. See Colonel.

Lieutenant-General. See General.

Lieutenant, in the land-ſervice, is the ſecond commiſſioned officer in every company of both foot and horſe, and next to the captain, and who takes the command upon the death or abſence of the captain.

Lieutenant of Artillery. Each company of artillery hath four; 1 firſt and 3 ſecond lieutenants. The firſt lieutenant hath the ſame detail of duty with the captain; becauſe in his abſence he commands the company: he is to ſee that the ſoldiers are clean and neat; that their clothes, arms, and accoutrements, are in good and ſerviceable order; and to watch over every thing elſe which may contribute to their health. He muſt give attention to their being taught the exerciſe, ſee them punctually paid, their meſſes regularly kept, and to viſit them in the hoſpitals when ſick. He muſt aſſiſt at all parades, &c. He ought to underſtand the doctrine of projectiles and the ſcience of artillery, with the various effects of gun-powder, however managed or directed; to enable him to conſtruct and diſpoſe his batteries to the beſt advantage; to plant his cannon, mortars, and howitzers, ſo as to produce the greateſt annoyance to an enemy. He is to be well ſkilled in the attack and defence of fortified places; and to be converſant in arithmetic, mathematics, mechanics, &c.

Second Lieutenant in the Artillery, is the ſame as an enſign in an infantry regiment, being the youngeſt commiſſioned officer in the company, and muſt aſſiſt the firſt lieutenant in the detail of the company's duty. His other qualifications ſhould be equal with thoſe of the firſt lieutenant.

Lieutenant of a ſhip of War, the officer next in rank and power to the captain, in whoſe abſence he is accordingly charged with the command of the ſhip, as alſo the execution of whatever orders he may have received from the commander relating to the king's ſervice.

The lieutenant who commands the watch at ſea, keeps a liſt of all the officers and men thereto belonging, in order to muſter them when he judges it expedient, and report to the captain the names of thoſe who are abſent from their duty. During the night-watch, he occaſionally viſits the lower decks, or ſends thither a careful officer, to ſee that the proper centinels are at their duty, and that there is no diſorder amongſt the men; no tobacco ſmoked between decks, nor any fire or candles burning there, except the lights which are in lanthorns, under the care of a proper watch, on particular occaſions. He is expected to be always upon deck in his watch, as well to give the neceſſary orders with regard to trimming the ſails and ſuperintending the navigation, as to prevent any noiſe or confuſion; but he is never to change the ſhip's courſe without the captain's directions, unleſs to avoid an immediate danger.

The lieutenant, in time of battle, is particularly to ſee that all the men are preſent at their quarters, where they have been previouſly ſtationed according to the regulations made by the captain. He orders and exhorts them every where to perform their duty; and acquaints the captain at all other times of the miſbehaviour of any perſon in the ſhip, and of whatever elſe concerns the ſervice or diſcipline. Lieutenant, Life.

The youngeſt lieutenant in the ſhip, who is alſo ſtyled *lieutenant at arms*, beſides his common duty, is particularly ordered, by his inſtructions, to train the ſeamen to the uſe of ſmall arms, and frequently to exerciſe and diſcipline them therein. Accordingly his office, in time of battle, is chiefly to direct and attend them; and at all other times to have a due regard to the preſervation of the ſmall arms, that they be not loſt or embezzled, and that they are kept clean and in good condition for ſervice.

Lieutenant-Reformed, he whoſe company or troop is broke or diſbanded, but continued in whole or half-pay, and ſtill preſerves his right of ſeniority and rank in the army.

LIFE, is peculiarly uſed to denote the animated ſtate of living creatures, or the time that the union of their ſoul and body laſts.

The Prolongation of Life is made by Lord Bacon one of the three branches of medicine; the other two relating to the preſervation of health, and the cure of diſeaſes. See Medicine.

The theory of prolonging life he numbers among the deſiderata. Some means or indications that ſeem to lead to it, he lays down as follow.

Things are preſerved in two manners; either in their *identity*, or by *reparation*. In their *identity*; as a fly or ant in amber; a flower, or fruit, or wood, in a conſervatory of ſnow; a dead carcaſe in balſams. By *reparation*; as a flame, or a mechanical engine, &c. To attain to the prolongation of life, both theſe methods muſt be uſed. And hence, according to him, ariſe three intentions for the prolongation of life: *Retardation* of conſumption, proper *reparation*, and *renovation* of what begins to grow old.

Conſumption is occaſioned by two kinds of depredation; a depredation of the innate ſpirit, and a depredation of the ambient air. Theſe may be each prevented two ways; either by rendering thoſe agents leſs predatory, or by rendering the paſſive parts (*viz.* the juices of the body) leſs liable to be preyed on. The ſpirit will be rendered leſs predatory, if either its ſubſtance be condenſed, as by the uſe of opiates, grief, &c.; or its quantity diminiſhed, as in ſpare and monaſtic diets; or its motion calmed, as in idleneſs and tranquillity. The ambient air becomes leſs predatory, if it be either leſs heated by the rays of the ſun, as in cold climates, in caves, mountains, and anchorets cells; or be kept off from the body, as by a denſe ſkin, the feathers of birds, and the uſe of oils and unguents without aromatics. The juices of the body are rendered leſs liable to be preyed on, either by making them harder or more moiſt and oily: harder, as by a coarſe ſharp diet, living in the cold, robuſt exerciſes, and ſome mineral baths: moiſter, as by the uſe of ſweet foods, &c. abſtaining from ſalts and acids; and eſpecially by ſuch a mixture of drink as conſiſts wholly of fine ſubtile particles, without any acrimony or acidity.

Reparation is performed by means of aliment; and alimentation is promoted four ways: By the concoction of the viſcera, ſo as to extrude the aliment: By exciting the exterior parts to the attraction of the aliment; as in proper exerciſes and frications, and ſome unctions and

Life, Ligature.

and baths: By the preparation of the food itſelf, ſo as it may more eaſily inſinuate itſelf, and in ſome meaſure anticipate the digeſtion; as in various ways of dreſſing meats, mixing drinks, fermenting breads, and reducing the virtues of theſe three into one: By promoting the act of aſſimilation itſelf, as in ſeaſonable ſleep, ſome external application, &c.

The *renovation* of what begins to grow old, is performed two ways: By the inteneration of the habit of the body; as in the uſe of emollients, emplaſters, unctions, &c. of ſuch a nature, as do not extract but impreſs: Or by purging off the old juices, and ſubſtituting freſh ones; as in ſeaſonable evacuations, attenuating diets, &c.

The ſame author adds theſe three axioms: That the prolongation of life is to be expected, rather from ſome ſtated diets, than either from any ordinary regimen or any extraordinary medicines; more from operating on the ſpirits, and mollifying the parts, than from the manner of feeding; and this mollifying of the parts without is to be performed by ſubſtantials, impriments, and occludents. See LONGEVITY.

Vegetable LIFE. See PLANTS.

LIFE-Rent, in Scots law. When the uſe and enjoyment of a ſubject is given to a perſon during his life, it is ſaid to belong to him in life-rent.

LIGAMENT, in its general ſenſe, denotes any thing that ties or binds one part to another.

LIGAMENT, in anatomy, a ſtrong compact ſubſtance, ſerving to join two bones together. See ANATOMY, n° 7.

LIGARIUS (Quintus), a Roman proconſul in Africa, 49 B. C. Taking part with Pompey, he was forbid by Julius Cæſar to return to Rome: to obtain his pardon, Cicero made that admired oration in his defence which has immortalized the memory of the client with that of his celebrated advocate.

LIGATURE, in ſurgery, is a cord, band, or ſtring; or the binding any part of the body with a cord, band, fillet, &c. whether of leather, linen, or any other matter.

Ligatures are uſed to extend or replace bones that are broken or diſlocated; to tie the patients down in lithotomy and amputations; to tie upon the veins in phlebotomy, on the arteries in amputations, or in large wounds; to ſecure the ſplints that are applied to fractures; to tie up the proceſſes of the peritoneum with the ſpermatic veſſels in caſtration; and, laſtly, in taking off warts or other excreſcences by ligature.

LIGATURE, is alſo uſed to ſignify a kind of bandage or fillet, tied round the neck, arm, leg, or other part of the bodies of men or beaſts, to divert or drive off ſome diſeaſe, accident, &c.

LIGATURE is alſo uſed for a ſtate of impotency, in reſpect to venery, pretended to be cauſed by ſome charm or witchcraft.

Kæmpfer tells of an uncommon kind of ligature or knotting, in uſe among the people of Maſſacar, Java, Malaja, Siam, &c. By this charm or ſpell, a man binds up a woman, and a woman a man, ſo as to put it out of their power to have to do with any other perſon; the man being thereby rendered impotent to any other woman, and all other men impotent with reſpect to the woman.

Ligature, Light.

Some of their philoſophers pretend, that this ligature may be effected by the ſhutting of a lock, the drawing of a knot, or the ſticking of a knife in the wall, at the point of time wherein the prieſt is joining a couple together; and that a ligature, thus effected, may be diſſolved, by the ſpouſe's urining through a ring. This piece of ſuperſtition is ſaid to obtain alſo among the Chriſtians of the Eaſt.

The ſame author tells us, that during the ceremony of marriage in Ruſſia, he obſerved an old fellow lurking behind the church-door, and mumbling over a ſtring of words; and, at the ſame time, cutting a long rod, which he held under his arm, into pieces; which, it ſeems, is a common practice at the marriages of great perſons, and done with deſign to elude and counterwork any other perſon that might poſſibly be inducing the ligature.

The ſecret of inducing a ligature is delivered by the ſame author, as he was taught it on the ſpot by one of their adepts: but it is too abſurd and obſcene to deſerve being tranſcribed here.

M. Marſhal mentions a ridiculous form of ligature, which he received from a bramin at Indoſtan: "If (ſays he) the little worm in the wood lukerara kara be cut into two, and the one part ſtirs and the other not, if the ſtirring part be bruiſed, and given with half a beetle to a man, and the other half to a woman, the charm will keep each from ever having to do with any other perſon." Phil. Tranſ. N° 268.

LIGATURE, in the Italian muſic, ſignifies a tying or binding together of notes. Hence ſyncopes are often called *ligatures*, becauſe they are made by the ligature of many notes. There is another ſort of ligatures for breves, when there are many of theſe on different lines, or on different ſpaces, to be ſung to one ſyllable.

LIGATURES, among printers, are types conſiſting of two letters or characters joined together; as *a*, *&*, *ff*, *ft*, *fi*. The old editions of Greek authors are extremely full of ligatures; the ligatures of Stephens are by much the moſt beautiful. Some editions have been lately printed without any ligatures at all; and there was a deſign to explode them quite out of printing. Had this ſucceeded, the fineſt ancient editions would in time have grown uſeleſs; and the reading of old manuſcripts would have been rendered almoſt impracticable to the learned themſelves.

LIGHT, in the moſt common acceptation of the word, ſignifies that inviſible etherial matter which makes objects perceptible to our ſenſe of ſeeing. Figuratively, it is alſo uſed for whatever conveys inſtruction to our minds, and likewiſe for that inſtruction itſelf.

I

Opinions of the firſt philoſophers concerning light.

The nature of light hath been a ſubject of ſpeculation from the earlieſt ages of philoſophy. Some of thoſe firſt diſtinguiſhed by the appellation of philoſophers even doubted whether objects became viſible by means of any thing proceeding from them, or from the eye of the ſpectator. The fallacy of this notion muſt very ſoon have been apparent, becauſe, in that caſe, we ought to have ſeen as well in the night as in the day. The opinion was therefore qualified by Empedocles and Plato; who maintained, that viſion was occaſioned by particles continually flying off from the ſurfaces of bodies, which met with others proceeding from

Light. from the eye; but Pythagoras aſcribed it ſolely to the particles proceeding from the external objects and entering the pupil of the eye.

2 Of Des Cartes. Among the modern philoſophers there have been two celebrated opinions, *viz.* the Carteſian and Newtonian. According to the former, light is an inviſible fluid preſent at all times and in all places, but which requires to be ſet in motion by an ignited or otherwiſe properly qualified body in order to make objects viſible to us.

3 Of Sir Iſaac Newton. —The Newtonians maintain, that light is not a fluid *per ſe*, but conſiſts of a vaſt number of exceedingly ſmall particles ſhaken off in all directions from the luminous body with inconceivable velocity by a repulſive power; and which moſt probably never return again to the body from which they were emitted. Theſe particles are alſo ſaid to be emitted in right lines by the body from whence they proceed: and this rectilinear direction they preſerve until they are turned out of their original path by the attraction of ſome other body near which they paſs, and which is called *inflection*; by paſſing through a medium of different denſity, which is called *refraction*, or by being thrown obliquely or directly forward by ſome body which oppoſes their paſſage, and which is called *reflection*; or, laſtly, till they are totally ſtopped by the ſubſtance of any body into which they penetrate, and which is called their *extinction*. A ſucceſſion of theſe particles following one another in an exactly ſtraight line is called a *ray of light*; and this ray, in whatever manner it hath its direction changed, whether by refraction, reflection, or inflection, always preſerves its rectilinear courſe; neither is it poſſible by any art whatever to make it paſs on in the ſegment of a circle, ellipſis, or other curve. — From ſome obſervations on the eclipſes of Jupiter's ſatellites, and alſo on the aberration of the fixed ſtars, it appears that the particles of light move at the rate of little leſs than 200,000 miles in a ſecond of time. See ASTRONOMY-*Index*.

4 Objections to the Newtonian doctrine. To this doctrine concerning the nature of light ſeveral objections have been made; the moſt conſiderable of which is, That in this caſe, as rays of light are continually paſſing in different directions from every viſible point, they muſt neceſſarily interfere with and deſtroy each other in ſuch a manner as entirely to confound all diſtinct perception of objects, if not to deſtroy the ſenſe of ſeeing altogether; not to mention the continual waſte of ſubſtance which a conſtant emiſſion of particles muſt occaſion in the luminous body, and which ſince the creation ought to have greatly diminiſhed the ſun and ſtars, as well as increaſed the bulk of the earth and planets by the vaſt quantity of particles of light abſorbed by them in ſuch a long period of time.

5 Anſwer by Mr Melville. In anſwer to this objection, Mr Melville gives ſome ingenious illuſtrations concerning the extreme ſubtilty of light, or the ſmallneſs of the particles of which it conſiſts, and of which few perſons, even of thoſe who admit the hypotheſis, have any idea. He obſerves, that there is probably no phyſical point in the viſible horizon that does not ſend rays to every other point, unleſs where opaque bodies interpoſe. Light, in its paſſage from one ſyſtem to another, often paſſes thro' torrents of light iſſuing from other ſuns and ſyſtems, without ever interfering or being diverted in its courſe, either by it, or by the particles of that elaſtic medium which ſome phenomena give us reaſon to ſuppoſe are diffuſed through all the mundane ſpace. To account for this fact and others ſimilar to it, he concludes, that the particles of which light conſiſts muſt be incomparably rare, even when they are the moſt denſe; that is, that the ſemidiameters of the two neareſt particles, in the ſame or in different beams, ſoon after their emiſſion, are incomparably leſs than their diſtance from one another. This difficulty concerning the non-interference of the particles of light is not ſolved, as he obſerves, by ſuppoſing with Mr Boſcovich and others, that each particle is endued with an inſuperable impulſive force; becauſe, in that caſe, their ſpheres of impulſion would even be more liable to interfere, and they would on that account be more likely to diſturb one another. Light.

6 By Mr Canton. The difficulty, according to Mr Canton, will nearly vaniſh, if a very ſmall portion of time be allowed between the emiſſion of every particle and the next that follows in the ſame direction. Suppoſe, for inſtance, that one lucid point of the ſun's ſurface emits 150 particles in a ſecond, which are more than ſufficient to give continual light to the eye without the leaſt appearance of intermiſſion; yet ſtill the particles of which it conſiſts, will on account of their great velocity be more than 1000 miles behind each other, and thereby leave room enough for others to paſs in all directions.

7 Experiments to determine the momentum of light. In order to determine whether light really conſiſts of particles emitted from the luminous body, or only in the vibrations of a ſubtile fluid, it has been attempted to find out its momentum, or the force with which it moves. The firſt who ſet about this matter with any tolerable pretenſions to accuracy was M. Mairan.

8 By Mr Mairan. Others indeed, particularly Hartſocker and Homberg, had pretended, that in certain caſes this momentum was very perceptible; but M. Mairan proved, that the effects mentioned by them were owing to currents of heated air produced by the burning-glaſſes uſed in their experiments, or to ſome other cauſes overlooked by theſe philoſophers. To decide the matter therefore, if poſſible, he began with trying the effects of rays collected by lenſes of four and ſix inches diameter, and thrown upon the needle of a compaſs; but the reſult was nothing more than ſome tremulous motion from whence he could draw no concluſion. After this, he and Mr du Fay conſtructed a kind of mill of copper, which moved with an exceeding ſlight impulſe; but though they threw upon it the focus of a lens of ſeven or eight inches diameter, they were ſtill unable to draw any concluſions from the reſult.

M. Mairan afterwards procured a horizontal wheel of iron three inches in diameter, having ſix radii, at the extremity of each of which was a ſmall wing fixed obliquely. The axis of the wheel, which was alſo of iron, was ſuſpended by a magnet. The wheel and the axis together did not weigh more than 30 grains; but though a motion was given to this wheel when the focus of the burning glaſs was thrown upon the extremities of the radii, yet it was ſo irregular, that he could not but conclude that it was occaſioned by the motion of the heated air. He then intended to have made his experiment *in vacuo*, but he concluded that it was unneceſſary. For, beſides the difficulty of making a vacuum, he was perſuaded that there was in our atmo-

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9 By Mr Michell. Mr Michell ſome years ago endeavoured to aſcertain the momentum of light in a manner ſtill more accurate. The inſtrument he made uſe of for this purpoſe conſiſted of a very thin plate of copper, a little more than an inch ſquare, which was faſtened to one end of a ſlender harpſichord-wire about ten inches long. To the middle of this was fixed an agate cap, ſuch as is commonly uſed for ſmall mariner's-compaſſes, after the manner of which it was intended to turn; and at the other end of the wire was a middling ſized ſhot-corn, as a counterpoiſe to the copperplate. The inſtrument had alſo fixed to it in the middle, at right angles to the length of the wire, and in an horizontal direction, a ſmall bit of a very ſlender ſewing-needle, about one-third or perhaps half an inch long, which was made magnetical. In this ſtate the whole inſtrument might weigh about 10 grains. It was placed on a very ſharp-pointed needle, on which the agate cap turned extremely freely; and to prevent its being diſturbed by any motion of the air, it was included in a box, the lid and front of which were of glaſs. This box was about 12 inches long, ſix or ſeven inches deep, and about as much in width; the needle ſtanding upright in the middle. At the time of making the experiment, the box was placed in ſuch a manner that a line drawn from the ſun paſſed at right angles to the length of it; and the inſtrument was brought to range in the ſame direction with the box, by means of the magnetical bit of needle above mentioned, and a magnet properly placed on the outſide, which would retain it, though with extremely little force, in any ſituation. The rays of the ſun were now thrown upon the copperplate above mentioned from a concave mirror of about two feet diameter, which, paſſing through the front-glaſs of the box, were collected into the focus of the mirror upon the copperplate. In conſequence of this the plate began to move, with a ſlow motion of about an inch in a ſecond of time, till it had moved through a ſpace of about two inches and a half, when it ſtruck againſt the back of the box. The mirror being removed, the inſtrument returned to its former ſituation by means of the little needle and magnet; and the rays of the ſun being then again thrown upon it, it again began to move, and ſtruck againſt the back of the box as before; and this was repeated three or four times with the ſame ſucceſs.—The inſtrument was then placed the contrary way in the box to that in which it had been placed before, ſo that the end to which the copperplate was affixed, and which had lain, in the former experiment, towards the right hand, now lay towards the left; and the rays of the ſun being again thrown upon it, it began to move with a ſlow motion, and ſtruck againſt the back of the box as before; and this was repeated once or twice with the ſame ſucceſs. But by this time the copperplate began to be ſo much altered in its form, by the extreme heat which it underwent in each experiment, and which brought it nearly into a ſtate of fuſion, that it became very much bent, and the more ſo as it had been unwarily ſupported by the middle, half of it lying above and half below the wire to which it was faſtened. By this means it now varied ſo much from the vertical poſition, that it began to act in the ſame manner as the ſail of a windmill, being impelled by the ſtream of heated air which moved upwards, with a force ſufficient to drive it in oppoſition to the impulſe of the rays of light. Light.

10 Dr Prieſtley's concluſions. "If we impute (ſays Dr Prieſtley) the motion produced in the above experiment to the impulſe of the rays of light, and ſuppoſe that the inſtrument weighed ten grains, and acquired a velocity of one inch in a ſecond, we ſhall find that the quantity of matter contained in the rays falling upon the inſtrument in that time amounted to no more than one twelve-hundredth-millionth part of a grain, the velocity of light exceeding the velocity of one inch in a ſecond in the proportion of about 12,000,000,000 to 1. Now the light in the above experiment was collected from a ſurface of about three ſquare feet, which reflecting only about half what falls upon it, the quantity of matter contained in the rays of the ſun incident upon a ſquare foot and an half of ſurface in one ſecond of time, ought to be no more than the twelve-hundred-millionth part of a grain, or, upon one ſquare foot only, the eighteen-hundred-millionth part of a grain. But the denſity of the rays of light at the ſurface of the ſun is greater than at the earth in the proportion of 45,000 to 1: there ought, therefore, to iſſue from one ſquare foot of the ſun's ſurface in one ſecond of time, in order to ſupply the waſte by light, one forty-thouſandth part of a grain of matter; that is, a little more than two grains in a day, or about 4,752,000 grains, or 670 pounds avoirdupoiſe nearly, in 6000 years; a quantity which would have ſhortened the ſun's ſemidiameter no more than about ten feet, if it was formed of the denſity of water only."

11 Objections againſt the Carteſian opinion by Sir Iſaac Newton. The Newtonians, beſides the anſwer juſt now given to the moſt formidable objections of their opponents, have endeavoured to prove the impoſſibility of light being a vibration in any fluid. Sir Iſaac, in his Principia, demonſtrates, that no rectilinear motion can be propagated among the particles of any fluid unleſs theſe particles lie in right lines; and he hath alſo ſhown, that all motion propagated through a fluid diverges from a rectilinear progreſs into the unmoved ſpaces. Hence he concludes, "a preſſure on a fluid medium (i. e. a motion propagated by ſuch a medium beyond any obſtacle, which impedes any part of its motion), cannot be propagated in right lines, but will be always inflecting and diffuſing itſelf every way, to the quieſcent medium beyond that obſtacle. The power of gravity tends downwards; but the preſſure of water riſing from it tends every way with an equable force, and is propagated with equal eaſe, and equal ſtrength, in curves, as in ſtraight lines. Waves, on the ſurface of the water, gliding by the extremes of any very large obſtacle, inflect and dilate themſelves, ſtill diffuſing gradually, into the quieſcent water beyond that obſtacle. The waves, pulſes, or vibrations of the air, wherein ſound conſiſts, are manifeſtly inflected, though not ſo conſiderably as the waves of water; and ſounds are propagated with equal eaſe, through crooked tubes and through ſtraight lines; but light was never known to move in any curve, nor to inflect itſelf *ad umbram*."

12 By Mr Rowning. To this Mr Rowning adds another proof. "The Carteſian notion of light (ſays he), was not that it is propagated from luminous bodies by the emiſſion of

ſmall

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ſmall particles, but that it was communicated to the organ of ſight by their preſſure upon the *materia ſubtilis*, with which they ſuppoſed the univerſe to be full. But, according to this hypotheſis, it could never be dark; becauſe, when a fluid ſuſtains any preſſure, if that fluid fills all the ſpace it takes up, abſolutely, without leaving any pores, which is the caſe of the ſuppoſed *materia ſubtilis*, then that preſſure muſt neceſſarily be communicated *equally* and *inſtantaneouſly* to every part. And therefore, whether the ſun were above or below the horizon, the preſſure communicated, and conſequently the light, would be the ſame. And farther, as the preſſure would be inſtantaneous, ſo would the light, which is contrary to what is collected from the eclipſes of Jupiter's ſatellites."

It is obvious, however, that whatever ſide we take concerning the nature of light, many, indeed almoſt all the circumſtances concerning it, are incomprehenſible, and beyond the reach of human underſtanding.

13 Unaccountable properties of light.

Moſt of the diſcous flowers, by ſome power unknown to us, follow the ſun in his courſe. They attend him to his evening retreat, and meet his riſing luſtre in the morning with the ſame unerring law. If a plant alſo is ſhut up in a dark room, and a ſmall hole is afterwards opened by which the light of the ſun may enter, the plant will turn towards that hole, and even alter its own ſhape in order to get near it; ſo that though it was ſtraight before, it will in time become crooked, that it may get near the light. It is not the *heat*, but the *light* of the ſun, which it thus covets; for, though a fire be kept in the room, capable of giving a much ſtronger heat than the ſun, the plant will turn away from the fire in order to enjoy the ſun's light.—The green colour of plants alſo depends on the ſun's light being allowed to ſhine upon them; for without this they are always white.—From this laſt circumſtance, and likewiſe the property which the ſolar light has of blackening precipitates of ſilver from the nitrous acid*, it has been thought that light either contains the *phlogiſton* in very conſiderable quantity, or is itſelf a modification of that unknown ſubſtance. But that this cannot be the caſe, we have now a proof little ſhort of demonſtration, from the laſt experiments of Dr Prieſtley concerning the production of pure dephlogiſticated air from pump-water, by means of the ſolar light†. If light either were the phlogiſton itſelf, or contained it in very conſiderable quantity, it is impoſſible the air produced by its means could be pure and dephlogiſticated.—For the properties of light acting as the medium of our perceptions by the ſenſe of ſight, ſee the article Optics.

* See *Chemiſtry*, n° 756.

14 Is not a modification of the phlogiſton.

† See *Aerology*, n° 36, *et ſeq.*

15 Dr Fordyce's experiments on the light produced by inflammation.

In the Philoſophical Tranſactions for 1776, Dr Fordyce gives an account of ſome experiments upon the light produced by Inflammation. They were made to determine, whether there was any light produced by the inflammation itſelf, independent of ignition. Subſtances, he obſerves, begin to be luminous in the dark when heated to between 6 and 700 degrees of Fahrenheit's thermometer. If the ſubſtances be colourleſs, they firſt emit a red light; then a red mixed with yellow; and laſtly, with a great degree of heat, a pure white. This whiteneſs, however, ſeems to depend greatly upon the denſity of the body; for the vapour at the end of the flame urged by a blow-pipe is not viſibly luminous, though its heat be ſufficiently great to give a white heat to glaſs. The colour of the ignited matter, according to our author, has an effect upon the colour of the light emitted. Thus, during the calcination of zinc, the calx of which is white, a light is produced farce inferior in beauty to that of the ſun himſelf. A beautiful green is communicated by the green calx of copper to the flame of a fire into which it is thrown; and the yellow empyreumatic oil into which tallow or any common oil is converted in burning, communicates a part of its own colour to the flame, which very much alters the appearance of bodies ſeen by candle-light from what it is by day-light. It does not, however, appear that this always holds good; for the flame of burning iron is intenſely white; and yet neither the metal itſelf nor any of its calces are of that colour.

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16 Colour of the ignited matter ſuppoſed to have an influence in the colour of the flame.

17 Light produced in ſome caſes with very little heat.

Light produced by the decompoſition of bodies by inflammation without ignition is always blue, and produces very little heat. Thus phoſphorus of urine is decompoſed by mere expoſure to the air, and gives but very little heat, though a conſiderable light is emitted. The following proof is adduced by our author that this emiſſion of light is a true inflammation. "Take a receiver of white glaſs, capable of holding ſix or eight gallons; put into it a drachm of phoſphorus finely powdered, and half an ounce of water; cork the mouth of the receiver, and tie it over with a bladder, ſo as to exclude the external air: incline the receiver to all ſides gently, and afterwards ſet it to reſt; the powder will adhere to the ſides, and the water will drain from it. As ſoon as the water is ſufficiently drained off, the particles of the phoſphorus will become luminous, and emit a thick ſmoke: this will continue for ſome days; but at laſt no more light or vapour will appear. Open the receiver, and you will find that the air will have contracted, as it does from the inflammation of a candle in Van Helmont's experiment; that is, about a twentieth part. It is become unfit for inflammation; for if a lighted candle be immerſed in it, it will be extinguiſhed as well as the phoſphorus, and an animal will be ſuffocated by it. The air then has ſuffered the ſame change as that which has ſerved for the inflammation of other bodies; and the phoſphorus is partly decompoſed, the water in the receiver being impregnated with its acid, and the air ſaturated with its phlogiſton. Blow freſh air into the receiver, and the light and ſmoke will immediately re-appear. In like manner it is known that ſulphur will burn and give light without heat ſufficient for ignition. Take a piece of iron heated nearly red hot, and throw a little gun-powder upon it. If the heat be of a proper degree, the ſulphur will burn off with a blue flame, without heat ſufficient for ignition; for if ſuch heat had been produced, the gun-powder would certainly have taken fire. It is the inflammation and decompoſition of the ſulphur, and not its evaporation, which produces the light; for if we ſublime ſulphur in veſſels of the moſt tranſparent glaſs, no light will be viſible except at the very beginning, when a ſmall portion of it burns till the air in the veſſel be ſaturated, and rendered unfit for inflammation."

18 Light from inflammation ſuppoſed to be always blue.

Our author is of opinion, that the light produced by inflammation is of a blue colour, from whatever body it is derived. This he endeavours to prove from an obſervation on the flame of a candle, the lower part of which, where the inflammation is, always appears of

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a blue colour. "Or (says he) take a candle which has burned for some time; extinguish it by applying tallow to the wick, and let it stand to cool; afterwards set it on fire by the flame of another candle; at first no more vapour will arise than can be acted upon by the air at once; inflammation, therefore, will go on in the whole small flame, and it will be blue. When a candle burns, the following process takes place. The tallow boils in the wick; and is converted into empyreumatic oil, rising from it in the form of vapour. As it rises from every part of the wick, the volume is increased till it comes to the top, and gives to the lower part of the flame the form of the frustum of an inverted cone. The air is applied to the outer surface of the column of vapour; and there decomposing the empyreumatic oil, produces heat and blue light: the stratum of vapour, within the outer burning surface, is heated white-hot; the heat diminishes towards the centre, which, if the flame be large, is scarcely red hot; as the column rises, decomposition taking place constantly on its surface, it necessarily diminishes, and the upper part of the flame is conical. That the tallow boils in the wick, can be seen: that it is converted into empyreumatic oil, is proved by drawing the vapour, rising in the middle of the flame, where it does not burn, into a glass-tube: the empyreumatic oil condenses; this also shows that the flame does not burn in the middle. That the heat is produced on the outer surface, appears, if we take a small rod of glass, and put the end of it in the blue flame on the surface; it will be heated white hot, and melt. Immerse the rod into the flame, so that the point shall be in the centre: it will melt and bend where it is in the blue flame on the surface; whereas, if the flame be large, the point which is in the centre will hardly be heated red-hot. That the empyreumatic oil is decomposed, is proved by burning a candle with a very small wick in distilling vessels; no condensation of empyreumatic oil takes place."

19 Observations on the burning of a candle.

20 Mr Morgan's observations upon light.

In the 75th volume of the Transactions, Mr Morgan treats the subject of light at some length. As a foundation for his reasoning he assumes the following data. 1. That light is a body, and, like all others, subject to the laws of attraction. 2. That light is an heterogeneous body; and that the same attractive power operates with different degrees of force on its different parts. 3. That the light which escapes from combustibles when decomposed by heat, or by any other means, was, previous to its escape, a component part of these substances. Hence he concludes, that when the attractive force by which the several rays of light are attached to a body is weakened, some of those rays will escape sooner than others; it being evident that those which are detained by the smallest power will soonest go off when the general attractive force is weakened. This he illustrates by the example of a mixture of spirit of wine, water, and other more fixed substances. The application of a gentle heat will carry off the spirit of wine only; a heat not much greater will evaporate the spirits and water mixed together; and a still greater degree will carry off a mixture of all the particles together. "In like manner (says he), when the surface of a combustible is in a state of decomposition, those parts of it which are the least fixed, or which are united with the least force, will be separated first. Amongst these the indigo rays of light will make the earliest appearance. By increasing the heat, we shall mix the violet with the indigo: by increasing it still more, we shall add the blue and the green to the mixture, till at length we reach that intensity of heat which will cause all the rays to escape at the same instant, and make the flame of a combustible perfectly white. By examining the flame of a common candle, we may observe, that its lowest extremities, or the part in which the black colour of the wick terminates, discharges the least heat; and that, as the vertex of the flame is approached, a successive order of parts is passed through, in which the lowest is continually adding to the heat of that which is just above it, till we come to the top of the flame, near which all the heat is collected into a focus. At the lowest extremity, however, where the heat is inconsiderable, a blue colour may always be observed; and from this appearance, amongst others, I think it may be concluded, that the blue rays are some of those which escape from combustibles in an early period of their decomposition; and that if the decomposition could be examined in a period still more early, the colour of the flame would be violet. By an *à priori* deduction of this kind, I was led to observe, that to the external boundary of the flame of a common candle is annexed a filament of light; which if proper care be taken to prevent the escape of too much smoke, will appear most beautifully coloured with the violet and indigo rays. If sulphur or ether be burned, or any other combustible whose vapour is kindled in a small degree of heat, a blue flame will appear; which, if examined by the prism, will be found to consist of the violet, the indigo, the blue, and sometimes a small quantity of the green rays. The best mode, however, of showing the escape of some rays by that degree of heat which will not separate others till increased, is the following. Give a piece of brown paper a spherical form, by pressing it upon any hard globular substance. Gradually bring the paper thus formed to that distance from the candle at which it will begin to take fire. In this case a beautiful blue flame may be seen hanging, as it were, by the paper till a hole is made in it; when the flame, owing to the increased action of the air upon all parts of it, becomes white, though the edges still continue of a blue or violet colour. As a confirmation of this, it may be observed, that the very flame, which when exposed to a certain degree of heat emits only the most refrangible rays, will, if exposed to one considerably greater, emit also those which are less so. The flames of sulphur and spirit of wine, if suddenly exposed to the heat of a reverberatory, will change their blue colour for one that is perfectly white."

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21 Remarks on the flame of a candle.

22 Curious experiment with a piece of brown paper.

23 Experiments on light by Melville's method.

To obtain a more perfect knowledge of this matter, our author examined the light proceeding from combustible bodies by Mr Melville's method. Having darkened the room, he interposed betwixt the eye and combustible a sheet of pasteboard, in which was a very small hole for transmitting the light. Viewing the light which passed through this hole with a prism, he observed, that the blue and violet rays were in greater abundance than any of the rest, though all the different kinds passed through it when spirit of wine only was made use of. When the combustion of the spirit of wine was checked by throwing in sal ammoniac, the red rays disappeared, but made their appearance again as soon as the salt became heated to such a degree as to

Light. increaſe rather than diminiſh the combuſtion of the ſpirits. On examining the different parts of the flame ſeparately, it was always found that the colours varied according to the degree of heat. At the baſe of the flame, or where the heat was leaſt, the indigo, violet, and blue always appeared in greateſt quantity; but as the vertex was approached, the other rays appeared, and at the very top they were all viſible through a priſm.

24 Concluſions from theſe experiments. From theſe facts Mr Morgan concludes, 1. That light, as an heterogeneous body, is gradually decompoſed during combuſtion; that the indigo rays eſcape with the leaſt heat, and the red with the greateſt; and from this again he explains the reaſon why flames aſſume different colours. "If a piece of paper (ſays he), impregnated with a ſolution of copper in nitrous acid, be ſet on fire, the bottom and ſides of the flame are always tinged green. Now this flame is evidently in that weak ſtate of decompoſition in which the moſt refrangible rays eſcape in the greateſt abundance; but of theſe the green rays eſcape moſt plentifully through the unignited vapour and that portion of the atmoſphere which is interpoſed betwixt the eye and the flame. This peculiarity may be obſerved in greateſt perfection in braſs founderies. Here the heat, though very ſtrong, is ſcarcely ſufficient to decompoſe the metallic vapour which eſcapes from the melted braſs; whence the flame has a very ſingular appearance, the edges being green, and the body of ſuch an appearance, as to give ſubſtances viewed by it a pallid and ghaſtly appearance, owing to the want of a ſufficient quantity of red rays to make a perfect white."

25 Red appearance of bodies in their laſt ſtate of ignition explained. 2. Mr Morgan explains the red appearance of bodies in their laſt ſtate of ignition, from the previous eſcape of the more refrangible rays, ſo that only the red ones remain. "Again, (ſays he), we may conſider the external ſurface of the combuſtible body as annexed to an inner ſurface, which may be partly, but not ſo perfectly decompoſed as itſelf: for the violence of the heat will be found to leſſen in its effects the nearer it approaches to the centre of the ſubſtance which is expoſed to it. Hence we are to conſider the parts which are juſt covered by the external ſurface as having loſt leſs of their component light than the external ſurface itſelf; or the former may retain the green rays when the latter has loſt both indigo, violet, blue, and green.

3. "Thoſe parts which are nearer the centre of the body than any of the preceding, muſt, as they are farther from the greateſt violence of the heat, have loſt proportionably fewer of their rays; or while the external parts may have loſt all but the red, theſe may have loſt only the indigo and violet.

4. "The moſt central parts may be unaffected by the heat; and whenever the fire does reach theſe parts, they will immediately diſcharge their indigo rays, and be decompoſed in the gradual manner already mentioned. A piece of rotten wood, while burning, will exemplify and confirm the preceding illuſtration. When influenced by the external air only, if examined through a priſm, no rays will be found to eſcape but the orange and the red. By blowing upon the burning wood with a pair of bellows, the combuſtion being increaſed, will affect thoſe internal parts of the body which were not acted upon before. Theſe parts therefore will begin to loſe their light, and a priſm will ſhow the green, blue, violet, and indigo, all appearing in ſucceſſion. Appearances ſimilar to the preceding may be obſerved in a common kitchen fire. When it is fainteſt, its colour is moſt red, the other rays having been emitted, and the combuſtion at a ſtand; but by blowing upon it in this ſtate, its brightneſs will be encreaſed, and more and more of the rays which are yielded by the internal parts of the body will come to the eye, till at length, by continuing to blow, the combuſtion will be made ſo complete as to yield all the rays, or to make it appear perfectly white." Light.

26 Sir Iſaac Newton's definition of *flame* criticiſed by Mr Morgan. Our author concludes the ſubject with a criticiſm upon Sir Iſaac Newton's definition of flame, viz. that it is a vapour heated red hot. In his opinion, flame is an inſtance of combuſtion whoſe colour will be determined by the degree of decompoſition which takes place. When very imperfect, only the moſt refrangible rays will appear. If it be very perfect, all the rays will appear, and its flame will be brilliant in proportion. But there are flames which conſiſt of burning particles, the rays of which have partly eſcaped before they aſcended in form of vapour. "Such (ſays he) would be the flame of a red hot coal, if expoſed to ſuch a heat as would gradually convert it into vapour. When the fire is very low under the furnace of an iron foundery, at the upper orifice of the chimney a red flame of this kind may be ſeen, which is different from the flame that appears immediately after freſh coals have been thrown upon the fire; for in conſequence of adding ſuch a ſupply to the burning fuel, a vaſt column of ſmoke aſcends, and forms a medium ſo thick as to abſorb moſt of the rays excepting the red."

27 Mr Morgan's theory not well founded. Thus we have a moſt elaborate theory for the ſolving of phenomena which ſeem not eaſily to admit of any ſolution. It is obvious, however, that the data upon which he builds his ſyſtem are altogether unfounded and hypothetical. That light is ſubject to the laws of attraction, cannot be proved unleſs we could examine it independent of any other ſubſtance whatever; that is to ſay, in a perfect vacuum; and even in the moſt perfect vacuum that can be formed, we are far from being certain that no other matter is preſent. Light is inflected and turned out of its courſe in many different ways when acting in the common atmoſphere, but we have no reaſon to ſuppoſe that it would be the ſame in a perfect vacuum; at leaſt we have not a right to lay it down as a principle to argue from, unleſs it were verified by experience. Even the heterogeneous nature of light ſeems far from being abſolutely eſtabliſhed. The refraction into different colours by the priſm ſeems inſufficient to do ſo; for though, by a quick revolution of theſe colours when painted upon any ſubſtance, we may produce a kind of white colour, it is by no means perfect, but looks as if ſome black had got amongſt it. The opinion of thoſe who maintain that the priſmatic colours are no other than different mixtures of light and ſhade, ſeems therefore equally probable with the other. His third poſition, that the light emitted by combuſtible bodies formed part of their ſubſtance before combuſtion, ſeems ſtill worſe founded; for inſtead of being fixed in ſolid ſubſtances, all the light and heat proceeding from combuſtion ſeem entirely to come from the air. By means of heat originally applied, the ſubſtance, or part of it, is rarefied into vapour; and this vapour, we have every reaſon to ſuppoſe, conſiſts of elementary fire united with the ſolid ſubſtance. It is this fire, heat, or light, which

Light. it afterwards thrown out from the vapour in combuſtion; and new ſupplies of it perpetually come from the atmoſphere, as is abundantly ſhown under the articles COMBUSTION, FIRE, FLAME, and many others throughout this work. We cannot therefore think it either inconſiſtent, or very improbable, that in the beginning of combuſtion, when the *white* light is clouded with a great quantity of vapour, it ſhould appear of a blue or violet colour; and that in proportion as this vapour is diſſipated, it ſhould appear green, yellow, red, or perfectly white: for it is obſervable, that in dephlogiſticated air, even thoſe flames which in the common atmoſphere always appear blue, ſuch as ſulphur and ſpirit of wine, are then changed to a dazzling white. The pure light of the ſun alſo ſeen through ſmoke, or even through a great quantity of aqueous vapour, appears red; and there is not the leaſt doubt, that if we were to view the ſun while he thus appears red through any blue medium, he would appear purple; and in like manner, were we to view a blue flame through a yellow medium, it would appear of a green colour.

28 His obſervations on electric light.

In the ſame paper Mr Morgan has ſome curious obſervations upon the electric light. There is neither fluid nor ſolid, he ſays, through which the electric fluid in its paſſage will not appear luminous, if we do not make the quantity, through which it has to paſs, too great. In his experiments on fluids, he puts them into a tube about three quarters of an inch diameter and four inches long. The orifices are then ſtopped up with two corks, through which two pointed wires are thruſt, ſo that the points may approach within one eighth part of an inch of each other; and in this caſe the electric matter which paſſes through the fluid is always luminous, provided a ſufficient force be uſed. The experiment, however, is dangerous, unleſs great care be taken; and the tube, unleſs it be very ſtrong, will be broken by a very ſlight diſcharge. With acids the experiment ſucceeds more difficultly; they muſt be put into capillary tubes, and the wires placed very near to each other. A ſtripe of gold leaf one eighth of an inch diameter, and a yard long, becomes quite luminous by diſcharging a battery over it; and our author cannot aſcertain the length to which it might be made luminous. The experiment will alſo ſucceed with Dutch metal or ſilver leaf. If the gold or ſilver leaf be put upon a glaſs, and that laid in water, the whole will appear moſt beautifully luminous on diſcharging a battery through it.

The better a conductor that any ſubſtance is, the greater is the difficulty of making the electric ſpark viſible in it. Hence it requires a much greater power of electricity to make a ſpark viſible in boiling than in cold water; the former being a much better conductor than the latter. In like manner, the mineral acids are much better conductors than common water; and, of conſequence, the ſpark is made to appear in them with much more difficulty than in water. This appears from what has been already mentioned; and our author likewiſe obſerves, that if a few drops of acid be poured into the tube containing the water employed for this purpoſe, it will ſcarcely be poſſible to make the ſpark luminous in it by any force.

The rarity of any body greatly increaſes the eaſe with which the electric ſpark is made viſible in it; as appears from diſcharging a vial through rarefied air, the vapour of ether, ſpirit of wine, or water. Light.

In the proſecution of his experiments upon this ſubject, our author cemented a ball of iron into the orifice of a tube 48 inches long, and two thirds of an inch diameter, ſo that it could bear the weight of the quickſilver with which the tube was filled all to a ſmall ſpace at the open end, which contained a few drops of water. Having inverted the tube, and plunged the open end of it into a baſon of mercury, that in the tube ſtood nearly half an inch lower than in a barometer with which it was compared at the ſame time, owing to the vapour which was formed by the water; but the ſpark paſſed as brilliant through the rarefied water as it does through rarefied air. If ſpirit of wine be employed inſtead of water in this experiment, the ſpark will not be ſo luminous. In the vapour of ether a great force is requiſite to make the ſpark luminous, but good ether will preſs the mercury down as far as 16 or 17 inches. By rarefying the vapour, however, the ſpark will paſs through it with more eaſe.

On examining the mineral acids *in vacuo*, Mr Morgan could not find that any vapour eſcaped from them. To give them the requiſite degree of tenuity, therefore, he traced a line upon glaſs about an eighth part of an inch broad, with a camel's hair pencil dipped in the acids: the line extended ſometimes to the length of 27 inches; in which caſe, the electric ſpark would paſs over the whole with great brilliancy. If by widening the line, however, or putting on a drop of acid in any particular part, the quantity was increaſed, the ſpark never appeared in that part.

29 Of the brightneſs of electric light.

The brightneſs of the electric light is always in proportion to its condenſation. Thus, if a ſpark taken from a powerful electrical machine divides itſelf into bruſhes, or throws out ſparks from the ſides, by which the light is diffuſed over a larger ſurface, it thus becomes leſs brilliant; and in all caſes in which any diffuſion of light, whether electric or not, takes place, the caſe will be the ſame.

30 Sometimes the more refrangible rays only eſcape from the electric fluid.

In ſome caſes, Mr Morgan is of opinion, that, even with the electric fluid, only the more refrangible rays of light make their eſcape. Thus, the electrical bruſh is always of a purpliſh or bluiſh colour; and if you convey a ſpark through a Torricellian vacuum not very perfectly made, it will be of an indigo colour. This, however, does not ſeem to ariſe from any other cauſe than the mere weakneſs of the light, which, in paſſing through the vapours of the atmoſphere, or perhaps through the humours of the eye itſelf, affects our organs of ſight in that manner.

13 Influence of media upon electric light.

Our author next proceeds to examine the influence of media upon electric light; which, he ſays, is ſimilar to their influence upon ſolar light, and ſerves to explain ſeveral phenomena.

"Let a pointed wire (ſays he), having a metallic ball fixed to one of its extremities, be forced obliquely into a piece of wood, ſo as to make a ſmall angle with its ſurface; and to make the point lie about one eighth of an inch below it. Let another pointed wire, which communicates with the ground, be forced in the ſame manner into the ſame wood, ſo that its point may in like manner be about one eighth of an inch below the ſurface, and about two inches diſtant from the point

Light.

32 Curious experiment of ſending the electric ſpark thro' wood.

of the firſt wire. Let the wood be inſulated, and a ſtrong ſpark, which ſtrikes on the metallic ball, will force its way through the interval of wood which lies between the points, and appear as red as blood. To prove that this appearance depends on the wood's abſorption of all the rays but the red, I would obſerve, that the greater the depth of the points is below the ſurface, the leſs mixed are the rays. When they are deepeſt below the ſurface, only the red come to the eye through a priſm; when raiſed a little nearer the ſurface, the red and orange appeared; when nearer ſtill, the yellow; and ſo on, till, by making the ſpark paſs through the wood very near its ſurface, all the rays were at length able to reach the eye. If the points be only one eighth of an inch below the ſurface of ſoft deal wood, the red, the orange, and the yellow rays will appear as the ſpark paſſes through it. But when the points are at an equal depth in a piece of harder wood, box for inſtance, the yellow, and perhaps the orange, will diſappear. As a farther proof of this abſorption of the rays, it may be obſerved, when the ſpark ſtrikes very bright upon one ſide of the piece of deal, it will appear quite red on the other. In like manner, a red appearance may be given to a ſpark which ſtrikes bright over the inſide of a tube, merely by ſpreading ſome pitch very thinly over the outſide of the ſame tube."

33 Different appearance of the electric ſpark at different diſtances.

Mr Morgan now proceeds to mention ſome experiments which ſeem to militate againſt the doctrine he has been endeavouring to eſtabliſh, rather than to ſupport it; viz. 1. If into a Torricellian vacuum of any length a few drops of ether are conveyed, and both ends of the vacuum ſtopped up with metallic conductors, ſo that a ſpark may paſs through it, the ſpark in its paſſage will make the following appearances. When the eye is placed cloſe to the tube, the ſpark will appear perfectly white; if the eye is removed to the diſtance of two yards, it will appear green; but at the diſtance of ſix or ſeven yards, it will appear reddiſh. "Theſe changes evidently depend (ſays our author) on the quantity of medium through which the light paſſes; and the red light more particularly, which we ſee at the greateſt diſtance from the tube, is accounted for on the ſame principle as the red light of the beclouded ſun, or a lighted candle."

2. Dr Prieſtley long ago obſerved the red appearance of the electric ſpark, when paſſing through inflammable air. But this appearance is very much diverſified according to the quantity of medium through which the ſpark is beheld. At a very conſiderable diſtance the red comes unmixed to the eye; but if the eye be placed cloſe to the tube, the ſpark appears white and brilliant. By increaſing, however, the quantity of fluid conveyed through any portion of inflammable air, or by condenſing that air, the ſpark may be made perfectly white. It may further be obſerved, that all weak exploſions and ſparks, when viewed at a diſtance, make a reddiſh appearance. The reaſon of theſe appearances ſeems to be, that the weaker the ſpark or exploſion is, the more it is diſpoſed to aſſume a red colour when viewed at a diſtance. This ſeems to confirm what has already been mentioned as a probable hypotheſis, that the different colours of light are entirely owing to the medium through which they are viewed.

On phoſphoric light Mr Morgan makes ſome curious obſervations; but ſtill argues on the ſame principles we have already mentioned. "Some ſhells (ſays he), prepared according to Mr Wilſon's directions*, after being expoſed to the ſun, or to the flaſh of a battery, emit a purple, others a green, and others a reddiſh light. If, with Mr Wilſon, we ſuppoſe that theſe ſhells are in a ſtate of ſlow combuſtion, may we not conclude that ſome are juſt beginning to burn, and therefore emitting the moſt refrangible rays; while others are in a more advanced ſtate of combuſtion, and therefore emitting the leaſt refrangible? If this concluſion be right, the ſhells which are emitting the purple or the green, muſt ſtill retain the yellow, the orange, and the red, which will alſo make their appearance as ſoon as the combuſtion is ſufficiently increaſed." In confirmation of this, Mr Morgan adduces the following experiment, viz. that if a ſhell, while emitting its green rays, be placed upon a warm ſhovel, the colour will ſoon be changed into a yellow mixed with red.—To the theory of ſlow combuſtion Mr Morgan makes the following objections.

Light.

33 Obſervations on phoſphoric light.

* See *Phoſphorus*.

1. If phoſphoric ſhells owe their light to this cauſe, we muſt conſider the word combuſtion, when applied to them, as implying all thoſe circumſtances which uſually attend a body when on fire. On this ſuppoſition there ought to be an increaſe of the heat as well as of the decompoſition of the combuſtible. But neither of theſe are found to take place in fact; for a phoſphoric body never fails to loſe its light entirely in a certain degree of heat, without loſing the power of becoming phoſphoric again when it has been ſufficiently cooled. While very hot, the charge of the ſtrongeſt battery conveyed over it has no effect.

2. When bodies are waſted by combuſtion, they can never be made to reaſſume the appearances which they previouſly diſplayed. "No power (ſays our author) can give to aſhes the phenomena of a burning coal. But phoſphoric bodies are very different in this reſpect; for a phoſphoric ſhell may be made to loſe all its light by expoſure to heat, and again may be made as luminous as ever by expoſure to the ſun."

3. It is remarkable that ſome bodies which are moſt beautifully phoſphoric, are at the ſame time the moſt obſtinate in reſiſting fire. "Let us now ſee (ſays Mr Morgan) the conſequence of admitting the common hypotheſis, that the detention of thoſe rays which fall upon phoſphori is owing to ſome force which prevents their immediate reflection, but is not adequate to their entire abſorption. This force, whatever it be, cannot well be ſuppoſed to operate with equal power on all theſe rays. If this be not the caſe, we cannot well avoid concluding, that phoſphoric ſhells will aſſume different colours, owing to the earlier and later eſcape of the different rays of light. This concluſion is juſtified by an experiment already mentioned; viz. that when the force is ſuch as to admit the eſcape of the purple, blue, and green, we have only to leſſen that force, by warming the body, and the yellow, the orange, and red eſcape. Beccaria has proved, that there is ſcarcely any body which is not phoſphoric, or may not become ſo by heat. But as the phoſphoric force is moſt powerful when the purple rays only eſcape, ſo we are to conclude, that it is weakeſt when it is able to retain the red rays only. This is agreeable to ſeveral facts.

Light. Chalk, oyſter-ſhells, together with thoſe phoſphoric bodies whoſe goodneſs has been very much impaired by long keeping, when finely powdered, and placed within the circuit of an electrical battery, will exhibit, by their ſcattered particles, a ſhower of light; but theſe particles will appear reddiſh, or their phoſphoric power will be ſufficient only to detain the yellow, orange, and red rays. When ſpirit of wine is in a ſimilar manner brought within the circuit of a battery, a ſimilar effect may be diſcovered; its particles diverge in ſeveral directions, diſplaying a moſt beautiful golden appearance. The metallic calces are rendered phoſphoric with the greateſt difficulty; but even theſe may be ſcattered into a ſhower of red luminous particles by the electric ſtroke."

In a poſtſcript to this paper, by Dr Price, it is obſerved, that by *phoſphoric force*, Mr Morgan ſeems to mean, not the force with which a phoſphoric body *emits*, but that with which it *abſorbs* and *retains*, the light. This laſt force is proportioned to the degree of attraction between the phoſphoric body and light; and therefore muſt, according to Mr Morgan's theory, be weakeſt when it ſo freely emits the light it has imbibed as not to retain thoſe rays which adhere to it moſt ſtrongly. According to Mr Morgan's theory, theſe are the rays which are the leaſt refrangible. "It is, however (ſays Dr Price), an objection to it, that the leſs refrangibility of rays ſeems to imply a leſs force of attraction between them and the ſubſtances which refract them; but it ſhould be conſidered, that, poſſibly, the force of coheſion, which unites the rays of light to bodies, may be a different power from that which refracts them."

Light independent of Heat. In general, a very conſiderable degree of heat is requiſite to the emiſſion of light from any body; but there are ſeveral exceptions to this, eſpecially in light proceeding from putreſcent ſubſtances and phoſphorus, together with that of luminous animals, and other ſimilar appearances. Light proceeding from putreſcent animal and vegetable ſubſtances, as well as from glow-worms, is mentioned by Ariſtotle. Thomas Bartholin mentions four kinds of luminous inſects, two with wings, and two without; but in hot climates travellers ſay they are found in much greater numbers, and of different ſpecies. Columna, an induſtrious naturaliſt, obſerves, that their light is not extinguiſhed immediately upon the death of the animal.

De luce animal, p. 183. 206.

34 Light from putrid fleſh.

The firſt diſtinct account that we meet with of light proceeding from putreſcent animal-fleſh is that which is given by Fabricius ab Aquapendente; who ſays, that when three Roman youths, reſiding at Padua, had bought a lamb, and had eaten part of it on Eaſter day 1592, ſeveral pieces of the remainder, which they kept till the day following, ſhone like ſo many candles when they were caſually viewed in the dark. Part of this luminous fleſh was immediately ſent to Aquapendente, who was profeſſor of anatomy in that city. He obſerved, that both the lean and the fat of this meat ſhone with a whitiſh kind of light; and alſo took notice, that ſome pieces of kid's fleſh, which had happened to have lain in contact with it, was luminous, as well as the fingers and other parts of the bodies of thoſe perſons who touched it. Thoſe parts, he obſerved, ſhone the moſt which were ſoft to the touch, and ſeemed to be tranſparent in candle light; but where the fleſh was thick and ſolid, or where a bone was near the outſide, it did not ſhine. Light.

De Viſione, p. 45.

After this appearance, we find no account of any other ſimilar to it, before that which was obſerved by Bartholin, and of which he gives a very pompous deſcription in his ingenious treatiſe already quoted. This happened at Montpelier in 1641, when a poor old woman had bought a piece of fleſh in the market, intending to make uſe of it the day following. But happening not to be able to ſleep well that night, and her bed and pantry being in the ſame room, ſhe obſerved ſo much light come from the fleſh, as to illuminate all the place where it hung. A part of this luminous fleſh was carried as a curioſity to Henry Bourbon, duke of Condé, the governor of the place, who viewed it for ſeveral hours with the greateſt aſtoniſhment.

This light was obſerved to be whitiſh; and not to cover the whole ſurface of the fleſh, but certain parts only, as if gems of unequal ſplendor had been ſcattered over it. This fleſh was kept till it began to putrify, when the light vaniſhed; which, as ſome religious people fancied, it did in the form of a croſs.

It is natural to expect, that the almoſt univerſal experimenal philoſopher Mr Boyle ſhould try the effect of his air-pump upon theſe luminous ſubſtances. Accordingly we find that he did not fail to do it; when he preſently found that the light of rotten wood was extinguiſhed *in vacuo*, and revived again on the admiſſion of the air, even after a long continuance *in vacuo*; but the extinguiſhing of this light was not ſo complete immediately upon exhauſting the receiver, as ſome little time afterwards. He could not perceive, however, that the light of rotten wood was increaſed in condenſed air; but this, he imagined, might ariſe from his not being able to judge very well of the degree of light, through ſo thick and cloudy a glaſs-veſſel as he then made uſe of; but we find that the light of a ſhining fiſh, which was put into a condenſing engine before the Royal Society, in 1668, was rendered more vivid by that means. The principal of Mr Boyle's experiments were made in October 1667.

Works, vol. iii. p. 156.

Birch's hiſt. ii. 254.

This philoſopher attended to a great variety of circumſtances relating to this curious phenomenon. Among other things he obſerved, that change of air was not neceſſary to the maintenance of this light; for it continued a long time when a piece of the wood was put into a very ſmall glaſs hermetically ſealed, and it made no difference when this tube which contained the wood was put into an exhauſted receiver. This he alſo obſerved with reſpect to a luminous fiſh, which he put into water, and placed in the ſame circumſtances. He alſo found, that the light of ſhining fiſhes had other properties in common with that of ſhining wood; but the latter, he ſays, was preſently quenched with water, ſpirit of wine, a great variety of ſaline mixtures, and other fluids. Water, however, did not quench all the light of ſome ſhining veal on which he tried it, though ſpirit of wine deſtroyed its virtue preſently.

Mr Boyle's obſervation of light proceeding from fleſh-meat was quite caſual. On the 15th of February 1662, one of his ſervants was greatly alarmed with the ſhining of ſome veal, which had been kept a few days, but had no bad ſmell, and was in a ſtate very proper for uſe. The ſervant immediately made his maſter acquainted with this extraordinary appearance;

Light. ance; and though he was then in bed, he ordered it to be immediately brought to him, and he examined it with the greateſt attention. Suſpecting that the ſtate of the atmoſphere had ſome ſhare in the production of this phenomenon, he takes notice, after deſcribing the appearance, that the wind was ſouth-weſt and bluſtering, the air hot for the ſeaſon, the moon was paſt its laſt quarter, and the mercury in the barometer was at 29 1/8 inches.

Birch, ii. 70.

35 Light from fiſhes. Mr Boyle was often diſappointed in his experiments on ſhining fiſhes; finding that they did not always ſhine in the very ſame circumſtances, as far as he could judge, with others which had ſhined before. At one time that they failed to ſhine, according to his expectations, he obſerved that the weather was variable, and not without ſome days of froſt and ſnow. In general he made uſe of whitings, finding them the fitteſt for his purpoſe. In a diſcourſe, however, upon this ſubject at the Royal Society in 1681, it was aſſerted, that, of all fiſhy ſubſtances, the eggs of lobſters, after they had been boiled, ſhone the brighteſt. Olig. Jacobœus obſerves, that, upon opening a ſea-polypus, it was ſo luminous, as to ſtartle ſeveral perſons who ſaw it; and he ſays, that the more putrid the fiſh was, the more luminous it grew. The nails alſo, and the fingers of the perſons who touched it, became luminous; and the black liquor which iſſued from the animal, and which is its bile, ſhone alſo, but with a very faint light.

Act. Hafn. vol. v. p. 282.

Mr Boyle draws a minute compariſon between the light of burning coals and that of ſhining wood or fiſh, ſhowing in what particulars they agree, and in what they differ. Among other things he obſerves, that extreme cold extinguiſhes the light of ſhining wood, as appeared when a piece of it was put into a glaſs tube, and held in a frigorific mixture. He alſo found that rotten wood did not waſte itſelf by ſhining, and that the application of a thermometer to it did not diſcover the leaſt degree of heat.

36 Of the pholas, a remarkably luminous fiſh. There is a remarkable ſhell-fiſh called PHOLAS, which forms for itſelf holes in various kinds of ſtone, &c. That this fiſh is luminous, was noticed by Pliny; who obſerves, that it ſhines in the mouth of the perſon who eats it, and, if it touch his hands or cloaths, makes them luminous. He alſo ſays that the light depends upon its moiſture. The light of this fiſh has furniſhed matter for various obſervations and experiments to M. Reaumur, and the Bolognian academicians, eſpecially Beccarius, who took ſo much pains with the ſubject of phoſphoreal light.

M. Reaumur obſerves, that, whereas other fiſhes give light when they tend to putreſcence, this is more luminous in proportion to its being freſh; that when they are dried, their light will revive if they be moiſtened either with freſh or ſalt water, but that brandy immediately extinguiſhes it. He endeavoured to make this light permanent, but none of his ſchemes ſucceeded.

The attention of the Bolognian academicians was engaged to this ſubject by M. F. Marſilius, in 1724, who brought a number of theſe fiſhes, and the ſtones in which they were incloſed, to Bologna, on purpoſe for their examination.

Com. Bonon. vol. ii. 232. Beccarius obſerved, that though this fiſh ceaſed to ſhine when it became putrid; yet that in its moſt putrid ſtate, it would ſhine, and make the water in which it was immerſed luminous, when they were agitated. Galeatius and Montius found, that wine or vinegar extinguiſhed this light: that in common oil it continued ſome days; but in rectified ſpirit of wine or urine, hardly a minute. Light.

In order to obſerve in what manner this light was affected by different degrees of heat, they made uſe of a Reaumur's thermometer, and found that water rendered luminous by theſe fiſhes increaſed in light till the heat arrived to 45 degrees; but that it then became ſuddenly extinct, and could not be revived.

In the experiments of Beccarius, a ſolution of ſea-ſalt increaſed the light of the luminous water, a ſolution of nitre did not increaſe it quite ſo much. Sal ammoniac diminiſhed it a little, oil of tartar *per deliquium* nearly extinguiſhed it, and the acids entirely. This water poured upon freſh calcined gypſum, rock cryſtal, ceruſs, or ſugar, became more luminous. He alſo tried the effects of it when poured upon various other ſubſtances, but there was nothing very remarkable in them. Afterwards, uſing luminous milk, he found that oil of vitriol extinguiſhed the light, but that oil of tartar increaſed it.

This gentleman had the curioſity to try how differently coloured ſubſtances were affected by this kind of light; and having, for this purpoſe, dipped ſeveral ribbons in it, the white came out the brighteſt, next to this was the yellow, and then the green; the other colours could hardly be perceived. It was not, however, any particular colour, but only light that was perceived in this caſe. He then dipped boards painted with the different colours, and alſo glaſs tubes, filled with ſubſtances of different colours, in water rendered luminous by the fiſhes. In both theſe caſes the red was hardly viſible, the yellow was the brighteſt, and the violet the dulleſt. But on the boards the blue was nearly equal to the yellow, and the green more languid; whereas in the glaſſes, the blue was inferior to the green.

Of all the liquors into which he put the pholades, milk was rendered the moſt luminous. A ſingle pholas made ſeven ounces of milk ſo luminous, that the faces of perſons might be diſtinguiſhed by it, and it looked as if it was tranſparent.

Air appeared to be neceſſary to this light; for when Beccarius put the luminous milk into glaſs tubes, no agitation would make it ſhine, unleſs bubbles of air were mixed with it. Alſo Montius and Galeatius found, that, in an exhauſted receiver, the pholas loſt its light, but the water was ſometimes made more luminous; which they aſcribed to the riſing of bubbles of air through it.

Beccarius, as well as Reaumur, had many ſchemes to render the light of theſe pholades permanent. For this purpoſe he kneaded the juice into a kind of paſte, with flour, and found that it would give light when it was immerſed in warm water; but it anſwered beſt to preſerve the fiſh in honey. In any other method of preſervation, the property of becoming luminous would not continue longer than ſix months, but in honey it had laſted above a year; and then it would, when plunged in warm water, give as much light as ever it had done.

Acta Caſarenſia, vol. v. p. 485.

Similar, in ſome reſpects, to thoſe obſervations on the light of the pholas, was that which was obſerved to

Light. to proceed from wood which was moiſt, but not in a putrid ſtate, which was very conſpicuous in the dark.

That the ſea is ſometimes luminous, eſpecially when it is put in motion by the daſhing of oars or the beating of it againſt a ſhip, has been obſerved with admiration by a great number of perſons. Mr Boyle, after reciting all the circumſtances of this appearance, as far as he could collect them from the accounts of navigators; as its being extended as far as the eye could reach, and at other times being viſible only when the water was daſhed againſt ſome other body; that, in ſome ſeas, this phenomenon is accompanied by ſome particular winds, but not in others; and that ſometimes one part of the ſea will be luminous, when another part, not far from it, will not be ſo; concludes with ſaying, that he could not help ſuſpecting that theſe odd phenomena, belonging to great maſſes of water, were in ſome meaſure owing to ſome coſmical law or cuſtom of the terreſtrial globe, or at leaſt of the planetary vortex.

37 Light from ſea-water

38 Dr Beal's experiments on fiſhes.

Some curious obſervations on the ſhining of ſome fiſhes, and the pickle in which they were immerſed, were made by Dr Beal, in May 1665; and had they been properly attended to and purſued, might have led to the diſcovery of the cauſe of this appearance. Having put ſome boiled mackerel into water, together with ſalt and ſweet herbs; when the cook was, ſome time after, ſtirring it, in order to take out ſome of the fiſhes, ſhe obſerved, that, at the firſt motion, the water was very luminous; and that the fiſh ſhining through the water added much to the light which the water yielded. The water was of itſelf thick and blackiſh, rather than of any other colour; and yet it ſhined on being ſtirred, and at the ſame time the fiſhes appeared more luminous than the water. Wherever the drops of this water, after it had been ſtirred, fell to the ground, they ſhined; and the children in the family diverted themſelves with taking the drops, which were as broad as a penny, and running with them about the houſe. The cook obſerved, that, when ſhe turned up that ſide of the fiſh that was loweſt, no light came from it; and that, when the water had ſettled for ſome time, it did not ſhine at all. The day following, the water gave but little light, and only after a briſk agitation, though the fiſhes continued to ſhine as well from the inſide as the outſide, and eſpecially about the throat, and ſuch places as ſeemed to have been a little broken in the boiling.

Phil. Tranſ. vol. lix. P. 450.

When, in the light of the ſun, he examined, with a microſcope, a ſmall piece of a fiſh which had ſhined very much the night before, he found nothing remarkable on its ſurface, except that he thought he perceived what he calls a *ſteam*, rather dark than luminous, ariſing like a very ſmall duſt from the fiſh, and here and there a very ſmall and almoſt imperceptible ſparkle. Of the ſparkles he had no doubt; but he thought it poſſible that the ſteam might be a deception of the ſight, or ſome duſt in the air.

Finding the fiſh to be quite dry, he moiſtened it with his ſpittle; and then obſerved that it gave a little light, though but for a ſhort time. The fiſh at that time was not fetid, nor yet inſipid to the beſt diſcerning palate. Two of the fiſhes he kept two or three days longer for farther trial: but, the weather being very hot, they became fetid; and, contrary to his expectations, there was no more light produced either by the agitation of the water or in the fiſh. Light.

39 Father Bourzes's account of luminous ſea-water.

Father Bourzes, in his voyage to the Indies in 1704, took particular notice of the luminous appearance of the ſea. The light was ſometimes ſo great, that he could eaſily read the title of a book by it, though he was nine or ten feet from the ſurface of the water. Sometimes he could eaſily diſtinguiſh, in the wake of the ſhip, the particles that were luminous from thoſe that were not; and they appeared not to be all of the ſame figure. Some of them were like points of light, and others ſuch as ſtars appear to the naked eye. Some of them were like globes, of a line or two in diameter; and others as big as one's head. Sometimes they formed themſelves into ſquares of three or four inches long, and one or two broad. Sometimes all theſe different figures were viſible at the ſame time; and ſometimes there were what he calls *vortices* of light, which at one particular time appeared and diſappeared immediately like flaſhes of lightning.

Nor did only the wake of the ſhip produce this light, but fiſhes alſo, in ſwimming, left ſo luminous a track behind them, that both their ſize and ſpecies might be diſtinguiſhed by it. When he took ſome of the water out of the ſea, and ſtirred it ever ſo little with his hand, in the dark, he always ſaw in it an infinite number of bright particles; and he had the ſame appearance whenever he dipped a piece of linen in the ſea, and wrung it in a dark place, even though it was half dry; and he obſerved, that when the ſparkles fell upon any thing that was ſolid, it would continue ſhining for ſome hours together.

40 His conjectures concerning the cauſe.

After mentioning ſeveral circumſtances which did not contribute to this appearance, this Father obſerves, that it depends very much upon the *quality of the water;* and he was pretty ſure that this light is the greateſt when the water is fatteſt, and fulleſt of foam. For in the main ſea, he ſays, the water is not everywhere equally pure; and that ſometimes, if linen be dipped in the ſea, it is clammy when it is drawn up again: and he often obſerved, that when the wake of the ſhip was the brighteſt, the water was the moſt fat and glutinous, and that linen moiſtened with it produced a great deal of light, if it was ſtirred or moved briſkly. Beſides, in ſome parts of the ſea, he ſaw a ſubſtance like ſaw-duſt, ſometimes red and ſometimes yellow; and when he drew up the water in thoſe places, it was always viſcous and glutinous. The ſailors told him, that it was the ſpawn of whales; that there are great quantities of it in the north; and that ſometimes, in the night, they appeared all over of a bright light, without being put in motion by any veſſel or fiſh paſſing by them.

As a confirmation of this conjecture, that the more glutinous the ſea-water is, the more it is diſpoſed to become luminous, he obſerves, that one day they took a fiſh which was called a *bonite*, the inſide of the mouth of which was ſo luminous, that, without any other light, he could read the ſame characters which he had before read by the light in the wake of the ſhip; and the mouth of this fiſh was full of a viſcous matter, which, when it was rubbed upon a piece of wood, made it immediately all over luminous; though, when the moiſture was dried up, the light was extinguiſhed.

The abbé Nollet was much ſtruck with the lumi-

Light. 41 Abbé Nollet's theory.

notiſneſs of the ſea when he was at Venice in 1749; and, after taking a great deal of pains to aſcertain the circumſtances of it, concluded that it was occaſioned by a ſhining inſect; and having examined the water very often, he at length did find a ſmall inſect, which he particularly deſcribes, and to which he attributes the light. The ſame hypotheſis had alſo occurred to M. Vianelli, profeſſor of medicine in Chioggia near Venice; and both he and M. Grizellini, a phyſician in Venice, have given drawings of the inſects from which they imagined this light to proceed.

The abbé was the more confirmed in his hypotheſis, by obſerving, ſome time after, the motion of ſome luminous particles in the ſea. For, going into the water, and keeping his head juſt above the ſurface, he ſaw them dart from the bottom, which was covered with weeds, to the top, in a manner which he thought very much reſembled the motions of inſects; though, when he endeavoured to catch them, he only found ſome luminous ſpots upon his handkerchief, which were enlarged when he preſſed them with his finger.

42 Obſervations of M. le Roi. *Memoires Preſentes*, vol. iii. 144.

M. le Roi, making a voyage on the Mediterranean, preſently after the abbé Nollet made his obſervations at Venice, took notice, that in the day-time, the prow of the ſhip in motion threw up many ſmall particles, which, falling upon the water, rolled upon the ſurface of the ſea for a few ſeconds before they mixed with it; and in the night the ſame particles, as he concluded, had the appearance of fire. Taking a quantity of the water, the ſame ſmall ſparks appeared whenever it was agitated; but, as was obſerved with reſpect to Dr Beal's experiments, every ſucceſſive agitation produced a leſs effect than the preceding, except after being ſuffered to reſt a while; for then a freſh agitation would make it almoſt as luminous as the firſt. This water, he obſerved, would retain its property of ſhining by agitation a day or two; but it diſappeared immediately on being ſet on the fire, though it was not made to boil.

This gentleman, after giving much attention to this phenomenon, concludes, that it is not occaſioned by any ſhining inſects, as the abbé Nollet imagined; eſpecially as, after carefully examining ſome of the luminous points, which he caught upon an handkerchief, he found them to be round like large pins heads, but with nothing of the appearance of any animal, though he viewed them with a microſcope. He alſo found, that the mixture of a little ſpirit of wine with water juſt drawn from the ſea, would give the appearance of a great number of little ſparks, which would continue viſible longer than thoſe in the ocean. All the acids, and various other liquors, produced the ſame effect, though not quite ſo conſpicuouſly; but no freſh agitation would make them luminous again. M. le Roi is far from aſſerting that there are no luminous inſects in the ſea. He even ſuppoſes that the abbé Nollet and M. Vianelli had found them. But he was ſatisfied that the ſea is luminous chiefly on ſome other account, though he does not ſo much as advance a conjecture about what it is.

43 Experiments by M. Ant. Martin.

M. Ant. Martin made many experiments on the light of fiſhes, with a view to diſcover the cauſe of the light of the ſea. He thought that he had reaſon to conclude, from a great variety of experiments, that all ſea-fiſhes have this property; but that it is not to be found in any that are produced in freſh water. Nothing depended upon the *colour* of the fiſhes, except that he thought that the white ones, and eſpecially thoſe that had white ſcales, were a little more luminous than others. This light, he found, was increaſed by a ſmall quantity of ſalt; and alſo by a ſmall degree of warmth, though a greater degree extinguiſhed it. This agrees with another obſervation of his, that it depends entirely upon a kind of moiſture which they had about them, and which a ſmall degree of heat would expel, when an oilineſs remained which did not give this light, but would burn in the fire. Light from the fleſh of birds or beaſts is not ſo bright, he ſays, as that which proceeds from fiſh. Human bodies, he ſays, have ſometimes emitted light about the time that they began to putrefy, and the walls and roof of a place in which dead bodies had often been expoſed, had a kind of dew or clammineſs upon it, which was ſometimes luminous; and he imagined that the lights which are ſaid to be ſeen in burying-grounds may be owing to this cauſe. Light. *Swed. Abhand.* vol. xxiii. p. 225.

44 By Mr Canton.

From ſome experiments made by Mr Canton, he concludes, that the luminouſneſs of ſea-water is owing to the ſlimy and other putreſcent ſubſtances it contains. On the evening of the 14th of June 1768, he put a ſmall freſh whiting into a gallon of ſea-water, in a pan which was about 14 inches in diameter, and took notice that neither the whiting nor the water, when agitated, gave any light. A Fahrenheit's thermometer, in the cellar where the pan was placed, ſtood at 54°. The 15th, at night, that part of the fiſh which was even with the ſurface of the water was luminous, but the water itſelf was dark. He drew the end of a ſtick through it, from one ſide of the pan to the other; and the water appeared luminous behind the ſtick all the way, but gave light only where it was diſturbed. When all the water was ſtirred, the whole became luminous, and appeared like milk, giving a conſiderable degree of light to the ſides of the pan; and it continued to do ſo for ſome time after it was at reſt. The water was moſt luminous when the fiſh had been in it about 28 hours; but would not give any light by being ſtirred, after it had been in it three days.

He then put a gallon of freſh water into one pan, and an equal quantity of ſea-water into another, and into each pan he put a freſh herring of about three ounces. The next night the whole ſurface of the ſea-water was luminous, without being ſtirred; but it was much more ſo when it was put in motion; and the upper part of the herring, which was conſiderably below the ſurface of the water, was alſo very bright; while at the ſame time, the freſh water, and the fiſh that was in it, were quite dark. There were ſeveral very bright luminous ſpots on different parts of the ſurface of the ſea-water; and the whole, when viewed by the light of a candle, ſeemed covered with a greaſy ſcum. The third night, the light of the ſea-water, while at reſt, was very little, if at all, leſs than before; but when ſtirred, its light was ſo great as to diſcover the time by a watch, and the fiſh in it appeared as a dark ſubſtance. After this, its light was evidently decreaſing, but was not quite gone before the 7th night.

The

Light. The freſh water and the fiſh in it were perfectly dark during the whole time. The thermometer was generally above 60°.

The preceding experiments were made with ſea-water: but he now made uſe of other water, into which he put common or ſea-ſalt, till he found, by an hydrometer, that it was of the ſame ſpecific gravity with the ſea-water; and, at the ſame time, in another gallon of water, he diſſolved two pounds of ſalt; and into each of theſe waters he put a ſmall freſh herring. The next evening the whole ſurface of the artificial ſea-water was luminous without being ſtirred; but gave much more light when it was diſturbed. It appeared exactly like the real ſea-water in the preceding experiment; its light laſted about the ſame time, and went off in the ſame manner: while the other water, which was almoſt as ſalt as it could be made, never gave any light. The herring which was taken out of it the ſeventh night, and waſhed from its ſalt, was found firm and ſweet; but the other herring was very ſoft and putrid, much more ſo than that which had been kept as long in freſh water. If a herring, in warm weather, be put into 10 gallons of artificial ſea-water, inſtead of one, the water, he ſays, will ſtill become luminous, but its light will not be ſo ſtrong.

It appeared by ſome of the firſt obſervations on this ſubject, that *heat* extinguiſhes the light of putreſcent ſubſtances. Mr Canton alſo attended to this circumſtance; and obſerves, that though the greateſt ſummer heat is well known to promote putrefaction, yet 20 degrees more than that of the human blood ſeems to hinder it. For putting a ſmall piece of a luminous fiſh into a thin glaſs ball, he found, that water of the heat of 118 degrees would extinguiſh its light in leſs than half a minute; but that, on taking it out of the water, it would begin to recover its light in about 10 ſeconds; but it was never afterwards ſo bright as before.

Mr Canton made the ſame obſervation that Mr Ant. Martin had done, *viz.* that ſeveral kinds of river fiſh could not be made to give light, in the ſame circumſtances in which any ſea-fiſh became luminous. He ſays, however, that a piece of carp made the water very luminous, though the outſide, or ſcaly part of it, did not ſhine at all.

For the ſake of thoſe perſons who may chooſe to repeat his experiments, he obſerves, that artificial ſea-water may be made without the uſe of an hydrometer, by the proportion of four ounces avoirdupois of ſalt to ſeven pints of water, wine-meaſure.

45 The ocean luminous from inſects.

From undoubted obſervations, however, it appears, that in many places of the ocean it is covered with luminous inſects to a very conſiderable extent. Mr Dagelet, a French aſtronomer who returned from the Terra Auſtralis in the year 1774, brought with him ſeveral kinds of worms which ſhine in water when it is ſet in motion; and M. Rigaud, in a paper inſerted (if we are not miſtaken) in the Journal des Sçavans for the month of March 1770, affirms, that the luminous ſurface of the ſea, from the port of Breſt to the Antilles, contains an immenſe quantity of little, round, ſhining polypuſes of about a quarter of a line in diameter. Other learned men, who acknowledge the exiſtence of theſe luminous animals, cannot, however, be perſuaded to conſider them as the cauſe of all that light and ſcintillation that appear on the ſurface of the ocean: they think that ſome ſubſtance of the phoſphorus kind, ariſing from putrefaction, muſt be admitted as one of the cauſes of this phenomenon. M. Godehoue has publiſhed curious obſervations on a kind of fiſh called in French *bonite*, already mentioned; and though he has obſerved, and accurately deſcribed, ſeveral of the luminous inſects that are found in ſea-water, he is, nevertheleſs, of opinion, that the ſcintillation and flaming light of the ſea proceed from the oily and greaſy ſubſtances with which it is impregnated.

Light.

The abbé Nollet was long of opinion, that the light of the ſea proceeded from electricity (A); though he afterwards ſeemed inclined to think, that this phenomenon was cauſed by ſmall animals, either by their luminous aſpect, or at leaſt by ſome liquor or effluvia which they emitted. He did not, however, exclude other cauſes; among theſe, the ſpawn or fry of fiſh deſerves to be noticed. M. Dagelet, ſailing into the bay of Antongil, in the iſland of Madagaſcar, obſerved a prodigious quantity of fry, which covered the ſurface of the ſea above a mile in length, and which he at firſt took for banks of ſand on account of their colour; they exhaled a diſagreeable odour, and the ſea had appeared with uncommon ſplendor ſome days before. The ſame accurate obſerver, perceiving the ſea remarkably luminous in the road of the Cape of Good Hope during a perfect calm, remarked, that the oars of the canoes produced a whitiſh and pearly kind of luſtre; when he took in his hand the water which contained this phoſphorus, he diſcerned in it, for ſome minutes, globules of light as large as the heads of pins. When he preſſed theſe globules, they appeared to his touch like a ſoft and thin pulp; and ſome days after the ſea was covered near the coaſts with whole banks of theſe little fiſh in innumerable multitudes.

46 Ignis fatuus.

To putrefaction, alſo, ſome are willing to attribute that luminous appearance which goes by the name of *ignis fatuus*, to which the credulous vulgar aſcribe very extraordinary and eſpecially miſchievous powers. It is moſt frequently obſerved in boggy places and near rivers, though ſometimes alſo in dry places. By its appearance benighted travellers are ſaid to have been ſometimes miſled into marſhy places, taking the light which they ſaw before them for a candle at a diſtance; from which ſeemingly miſchievous property it has been thought by the vulgar to be a ſpirit of a malignant nature, and been named accordingly *Will with a wiſp*, or *Jack with a lanthorn*; for the ſame reaſon alſo it probably had its Latin name *ignis fatuus*.

This kind of light is ſaid to be frequent about burying places and dung-hills. Some countries are alſo remarkable for it, as about Bologna in Italy, and ſome parts of Spain and Ethiopia. Its forms are ſo uncertain and variable that they can ſcarce be deſcribed, eſpecially as few philoſophical obſervers ever had the good fortune to meet with it. Dr Derham, however, happened

(A) This hypotheſis was alſo maintained in a treatiſe publiſhed at Venice in 1746, by an officer in the Auſtrian ſervice, under the title, *Dell' Eletreciſmo*.

Light. happened one night to perceive one of them, and got ſo near that he could have a very advantageous view of it. This is by no means eaſy to be obtained; for, among other ſingularities of the *ignis fatuus*, it is obſerved to avoid the approach of any perſon, and fly from place to place as if it was animated. That which Dr Derham obſerved was in ſome boggy ground betwixt two rocky hills; and the night was dark and calm; by which means, probably, he was enabled to advance within two or three yards of it. It appeared like a complete body of light without any diviſion, ſo that he was ſure it could not be occaſioned by inſects as ſome have ſuppoſed; the ſeparate lights of which he could not have failed to diſtinguiſh, had it been occaſioned by them. The light kept dancing about a dead thiſtle, till a very ſlight motion of the air, occaſioned, as he ſuppoſed, by his near approach to it, made it jump to another place; after which it kept flying before him as he advanced. M. Beccari endeavoured to procure all the intelligence he could concerning this phenomenon, by inquiring of all his acquaintance who might have had an opportunity of obſerving it. Thus he obtained information that two of theſe lights appeared in the plains about Bologna, the one to the north, and the other to the ſouth, of that city, and were to be ſeen almoſt every dark night, eſpecially that to the eaſtward, giving a light equal to an ordinary faggot. The latter appeared to a gentleman of his acquaintance as he was travelling; moved conſtantly before him for about a mile; and gave a better light than a torch which was carried before him. Both theſe appearances gave a very ſtrong light, and were conſtantly in motion, though this was various and uncertain. Sometimes they would riſe, ſometimes ſink; but commonly they would hover about ſix feet from the ground; they would alſo frequently diſappear on a ſudden, and appear again in ſome other place. They differed alſo in ſize and figure, ſometimes ſpreading pretty wide, and then contracting themſelves; ſometimes breaking into two, and then joining again. Sometimes they would appear like waves, at others they would ſeem to drop ſparks of fire: they were but little affected by the wind; and in wet and rainy weather were frequently obſerved to caſt a ſtronger light than in dry weather: they were alſo obſerved more frequently when ſnow lay upon the ground, than in the hotteſt ſummer; but he was aſſured that there was not a dark night throughout the whole year in which they were not to be ſeen. The ground to the eaſtward of Bologna, where the largeſt of theſe appearances was obſerved, is a hard chalky ſoil mixed with clay, which will retain the moiſture for a long time, but breaks and cracks in hot weather. On the mountains, where the ſoil is of a looſer texture, and leſs capable of retaining moiſture, the *ignes fatui* were leſs.

From the beſt information which M. Beccari was able to procure, he found that theſe lights were very frequent about rivers and brooks. He concludes his narrative with the following ſingular account. "An intelligent gentleman travelling in the evening, between eight and nine, in a mountainous road about ten miles ſouth of Bologna, perceived a light which ſhone very ſtrangely upon ſome ſtones which lay on the banks of the river Rioverde. It ſeemed to be about two feet above the ſtones, and not far from the water. In ſize and figure it had the appearance of a parallelopiped, ſomewhat more than a foot in length, and half a foot high, the longeſt ſide being parallel to the horizon. Its light was ſo ſtrong, that he could plainly diſcern by it part of a neighbouring hedge and the water of the river; only in the eaſt corner of it the light was rather faint, and the ſquare figure leſs perfect, as if it was cut off or darkened by the ſegment of a circle. On examining it a little nearer, he was ſurpriſed to find that it changed gradually from a bright red, firſt to a yellowiſh, and then to a pale colour, in proportion as he drew nearer; and when he came to the place itſelf, it quite vaniſhed. Upon this he ſtepped back, and not only ſaw it again, but found that the farther he went from it, the ſtronger and brighter it grew. When he examined the place of this luminous appearance, he could perceive no ſmell nor any other mark of fire." This account was confirmed by another gentleman, who informed M. Beccari, that he had ſeen the ſame light five or ſix different times in ſpring and in autumn; and that it always appeared of the ſame ſhape, and in the very ſame place. One night in particular, he obſerved it come out of a neighbouring field to ſettle in the uſual place. Light.

A very remarkable account of an *ignis fatuus* is given by Dr Shaw in his Travels to the Holy Land. It appeared in the valleys of mount Ephraim, and attended him and his company for more than an hour. Sometimes it would appear globular, or in the ſhape of the flame of a candle; at others it would ſpread to ſuch a degree as to involve the whole company in a pale inoffenſive light, then contract itſelf, and ſuddenly diſappear; but in leſs than a minute would appear again; ſometimes running ſwiftly along, it would expand itſelf at certain intervals over more than two or three acres of the adjacent mountains. The atmoſphere from the beginning of the evening had been remarkably thick and hazy; and the dew, as they felt it on the bridles of their horſes, was very clammy and unctuous.

Lights reſembling the *ignis fatuus* are ſometimes obſerved at ſea, ſkipping about the maſts and rigging of ſhips; and Dr Shaw informs us, that he has ſeen theſe in ſuch weather as that juſt mentioned when he ſaw the *ignis fatuus* in Paleſtine. Similar appearances have been obſerved in various other ſituations; and we are told of one which appeared about the bed of a woman in Milan, ſurrounding it as well as her body entirely. This light fled from the hand which approached it; but was at length entirely diſperſed by the motion of the air. Of the ſame kind alſo, moſt probably, are thoſe ſmall luminous appearances which ſometimes appear in houſes or near them, called in Scotland *Elf-candles*, and which are ſuppoſed to portend the death of ſome perſon about the houſe. In general theſe lights are harmleſs, though not always; for we have accounts of ſome luminous vapours which would encompaſs ſtacks of hay and corn, and ſet them on fire; ſo that they became objects of great terror and concern to the country people. Of theſe it was obſerved, that they would avoid a drawn ſword, or ſharp-pointed iron inſtrument, and that they would be driven away by a great noiſe; both which methods

Light. were made uſe of to diſſipate them; and it was likewiſe obſerved, that they came from ſome diſtance, as it were on purpoſe to do miſchief.

Several philoſophers have endeavoured to account for theſe appearances, but hitherto with no great ſucceſs; nor indeed does there ſeem to be ſufficient data for ſolving all their phenomena. Willoughby, Ray, and others, have imagined that the light was occaſioned by a number of ſhining inſects; but this opinion was never ſupported in ſuch a manner as to gain much ground. The *ignis fatuus* ſeen by Dr Derham above mentioned, as well as all the other inſtances we have related, ſeem to demonſtrate the contrary. Sir Iſaac Newton calls it a vapour ſhining without heat; and ſuppoſes that there is the ſame difference between the vapour of *ignis fatuus* and flame, that there is between the ſhining of rotten wood and burning coals. But though this ſeems generally to be the caſe, there are ſtill ſome exceptions, as has been inſtanced in the vapours which ſet fire to the ſtacks of corn. Dr Prieſtley ſuppoſes that the light is of the ſame nature with that produced by putreſcent ſubſtances; and others are of opinion, that the electrical fluid is principally concerned; but none have attempted to give any particular ſolution of the phenomena.

From the frequent appearance of the *ignis fatuus* in marſhes, moiſt ground, burying places, and dunghills, we are naturally led to conclude, that putrefaction is concerned in the production of it. This proceſs, we know, is attended with the emiſſion of an aqueous ſteam, together with a quantity of fixed, inflammable, phlogiſticated, and alkaline airs, all blended together in one common vapour. It is likewiſe attended with ſome degree of heat; and we know that there are ſome vapours, that of ſulphur particularly, which become luminous, with a degree of heat much leſs than that ſufficient to ſet fire to combuſtible bodies. There is no inconſiſtency, therefore, in ſuppoſing that the putrid vapour may be capable of ſhining with a ſtill ſmaller degree of heat than that of ſulphur, and conſequently become luminous by that which putrefaction alone affords. This would account for the *ignis fatuus*, were it only a ſteady luminous vapour ariſing from places where putrid matters are contained; but its extreme mobility, and flying from one place to another on the approach of any perſon, cannot be accounted for on this principle. If one quantity of the putrid vapour become luminous by means of heat, all the reſt ought to do ſo likewiſe: ſo that though we may allow heat and putrefaction to be concerned, yet of neceſſity we muſt have recourſe to ſome other agent, which cannot be any other than electricity. Without this it is impoſſible to conceive how any body of moveable vapour ſhould not be carried away by the wind; but, ſo far is this from being the caſe, that the *ignes fatui* deſcribed by M. Beccari were but little affected by the wind. It is beſides proved by undoubted experiment, that electricity always is attended with ſome degree of heat; and this, however ſmall, may be ſufficient to give a luminous property to any vapour on which it acts ſtrongly; not to mention, that the electric fluid itſelf is no other than that of light, and may therefore by its action eaſily produce a luminous appearance independent of any vapour.

We have a ſtrong proof that electricity is concerned, or indeed the principal agent, in producing the *ignis fatuus* from an experiment related by Dr Prieſtley of a flame of this kind being artificially produced. A gentleman, who had been making many electrical experiments for a whole afternoon in a ſmall room, on going out of it, obſerved a flame following him at ſome little diſtance. This, we have no reaſon to doubt, was a true *ignis fatuus*, and the circumſtances neceſſary to produce it were then preſent, viz. an atmoſphere impregnated with animal vapour, and likewiſe ſtrongly electrified. Both theſe circumſtances undoubtedly muſt have taken place in the preſent caſe; for the quantity of perſpiration emitted by a human body is by no means inconſiderable; and it as well as the electricity would be collected by reaſon of the ſmallneſs of the room. In this caſe, however, there ſeems to have been a conſiderable difference between the artificial *ignis fatuus* and thoſe commonly met with; for this flame *followed* the gentleman as he went out of the room; but the natural ones commonly fly from thoſe who approach them. This may be accounted for, from a difference between the electricity of the atmoſphere in the one room and the other; in which caſe the flame would naturally be attracted towards that place where the electricity was either different in quality or in quantity; but in the natural way, where all bodies may be ſuppoſed equally electrified for a great way round, a repulſion will as naturally take place. Still, however, this does not ſeem to be always the caſe. In thoſe inſtances where travellers have been attended by an *ignis fatuus*, we cannot ſuppoſe it to have been influenced by any other power than what we call *attraction*, and which electricity is very capable of producing. Its keeping at ſome diſtance is likewiſe eaſily accounted for; as we know that bodies poſſeſſed of different quantities of electricity may be made to attract one another for a certain ſpace, and then repel without having ever come into contact. On this principle we may account for the light which ſurrounded the woman at Milan, but fled from the hand of any other perſon. On the ſame principle may we account for theſe miſchievous vapours which ſet fire to the hay and corn ſtacks, but were driven away by preſenting to them a pointed iron inſtrument, or by making a noiſe. Both theſe are known to have a great effect upon the electric matter; and by means of either, even lightning may occaſionally be made to fall upon or to avoid particular places, according to the circumſtances by which the general maſs happens to be affected at that time.

On the whole, therefore, it ſeems moſt probable, that the *ignis fatuus* is a collection of vapour of the putreſcent kind, very much affected by electricity; according to the degree of which, it will either give a weak or ſtrong light, or even ſet fire to certain ſubſtances diſpoſed to receive its operation. This opinion ſeems greatly to be confirmed from ſome luminous appearances obſerved in privies, where the putrid vapours have even collected themſelves into balls, and exploded violently on the approach of a candle. This laſt effect, however, we cannot ſo well aſcribe to the electricity, as to the accenſion of the inflammable air which frequently abounds in ſuch places.

In the appendix to Dr Prieſtley's third volume of

Light. experiments and obſervations on air, Mr Warltire gives an account of ſome very remarkable *ignes fatui*, which he obſerved on the road to Bromſgrove, about five miles from Birmingham. The time of obſervation was the 12th of December 1776, before day-light. A great many of theſe lights were playing in an adjacent field, in different directions; from ſome of which there ſuddenly ſprung up bright branches of light, ſomething reſembling the exploſion of a rocket that contained many brilliant ſtars, if the diſcharge was upwards, inſtead of the uſual direction, and the hedge and trees on each ſide of the hedge were illuminated. This appearance continued but a few ſeconds, and then the jack-a-lanterns played as before. Mr Warltire was not near enough to obſerve if the apparent exploſions were attended with any report.

Cronſtedt gives it as his opinion, that *ignis fatuus*, as well as the meteors called *falling ſtars*, are owing to collections of inflammable air raiſed to a great height in the atmoſphere. But, with regard to the latter, the vaſt height at which they move evidently ſhows that they cannot be the effect of any *gravitating* vapour whatever; for the lighteſt inflammable air is one-twelfth of that of the common atmoſphere: and we have no reaſon to believe, that at the diſtance of 40 or 50 miles from the earth, the latter has near $\frac{1}{12}$ of its weight at the ſurface. From the account given by Mr Warltire, we ſhould be apt to conclude, that there is a ſtrong affinity betwixt the *ignes fatui* and fire-balls, inſomuch that the one might be very eaſily converted into the other. From this then we muſt aſcribe an electrical origin to the one as well as the other. Electricity, we know, can aſſume both theſe appearances, as is evident in the caſe of points; or even when the atmoſphere is violently electrified, as around the ſtring of an electrical kite, which always will appear to be ſurrounded with a blue flame in the night, if the electricity be very ſtrong.

On the whole, it appears, that electricity acting upon a ſmall quantity of atmoſpherical air, with a certain degree of vigour, will produce an appearance reſembling an *ignis fatuus*; with a ſuperior force it will produce a fire-ball; and a ſudden increaſe of electrical power might produce thoſe ſparks and apparent exploſions obſerved by Mr Warltire. The only difficulty therefore is, Why does electricity exert its power upon one portion of the atmoſphere rather than another, ſeeing it has an opportunity of diffuſing itſelf equally through the whole? To this it ſeems impoſſible to give any other reaſon than that we ſee the fact is ſo; and that in all caſes where there is a quantity of electrified air or vapour, there will be an accumulation in one part rather than another. Thus, in the experiment already related, where the gentleman perceived a blue flame following him, the whole air of the room was electrified, but the greateſt power of the fluid was exerted on that which gave the luminous appearance.

With regard to the uſes of the *ignes fatui* in the ſyſtem of nature, we can only ſay, that they ſeem to be accidental appearances reſulting from the motion of the electric fluid, and are, no doubt, like other meteors, ſubſervient to the preſervation of its equilibrium, and thus are uſeful in preventing thoſe dreadful commotions which enſue when a proper medium for ſo doing is deficient.

Light. A light in ſome reſpects ſimilar to thoſe above mentioned has been found to proceed from that celebrated chemical production called *phoſphorus*, which always tends to decompoſe itſelf, ſo as to take fire by the acceſs of *air* only. Phoſphorus, therefore, when it emits light, is properly a body ignited; though when a very ſmall quantity of it is uſed, as what is left after drawing it over paper, or what may be diſſolved in eſſential oil, the heat is not ſenſible. But perhaps the matter which emits the light in what we call *putreſcent ſubſtances* may be ſimilar to it, though it be generated by a different proceſs, and burn with a leſs degree of heat. Putreſcence does not ſeem to be neceſſary to the light of glow-worms, or of the pholades; and yet their light is ſufficiently ſimilar to that of ſhining wood or fleſh. Electric light is unqueſtionably ſimilar to that of phoſphorus, though the ſource of it is apparently very different.

47 Phoſphoric light.

Kunckel formed his phoſphorus into a kind of pills about the ſize of peas, which being moiſtened a little, and ſcraped in the dark, yielded a very conſiderable light, but not without ſmoke. The light was much more pleaſing when eight or ten of theſe pills were put into a glaſs of water; for being ſhaken in the dark, the whole glaſs ſeemed to be filled with light. Kunckel alſo reduced his phoſphorus into the form of larger ſtones; which being warmed by a perſon's hand, and rubbed upon paper, would deſcribe letters that were very legible in the dark.

The greateſt variety of experiments with the light of phoſphorus was made by Dr Slare; who ſays, that the liquid phoſphorus (which is nothing more than the ſolid phoſphorus diſſolved in any of the eſſential oils) would not hurt even a lady's hand; or that, when the hands or face were waſhed with it, it would not only make them viſible to other perſons in the dark, but that the light was ſo conſiderable as to make other neighbouring objects viſible.

When the ſolid phoſphorus is quite immerſed in water, he obſerves that it ceaſes to ſhine; but that if any part of it chance to emerge, or get into the air, it will ſhine though the glaſs be hermetically ſealed. In a large glaſs he kept it without water for ſeveral days; and yet it continued ſhining, with very little diminution of its light or weight. If the letters that were written with this phoſphorus were warmed by the fire, they preſently became dark lines, which continued upon the paper, like ink. To try how much light was given by a ſmall quantity of this phoſphorus, he obſerved that it continued to flame in the open air for ſeven or eight days; the light being viſible whenever he ſhut his window.

As air was generally thought to contain the *pabulum* of flame, Dr Slare was determined to try this with reſpect to phoſphorus; and for this purpoſe he placed a large piece of it in a receiver; but upon exhauſting it, he perceived that it became more luminous, and that, upon admitting the air, it returned to its former ſtate. This property of the light of phoſphorus, which is the very reverſe of that of ſhining wood and fiſhes, was alſo aſcertained by ſeveral very accurate experiments of Mr Haukſbee's.

Endeavouring to blow the phoſphorus into a flame with a pair of bellows, Dr Slare found that it was preſently blown out, and that it was a conſiderable time before

Light. before the light revived again. All liquors would extinguiſh this light when the phoſphorus was put into them; nor would it ſhine or burn, though it was even boiled in the moſt inflammable liquors, as oil of olives, ſpirit of turpentine, or even ſpirit of wine.

In order to keep his phoſphorus from conſuming, he uſed to put it in a glaſs of water; and ſometimes he has ſeen it, when thus immerſed in water, make ſuch bright and vigorous coruſcations in the air, as, he ſays, would ſurpriſe and frighten thoſe who are not uſed to the phenomenon. This fiery meteor, he ſays, is contracted in its paſſage through the water, but expands as ſoon as it gets above it. If any perſon would make this experiment to advantage, he informs them that the glaſs muſt be deep and cylindrical, and not above three quarters filled with water. This effect he perceived in warm weather only, and never in cold.

The phoſphorus of which we have been treating is prepared from urine; but in ſome caſes the ſweat, which is ſimilar to urine, has been obſerved to be phoſphoraceous, without any preparation. This once happened to a perſon who uſed to eat great quantities of ſalt, and who was a little ſubject to the gout, after ſweating with violent exerciſe. Stripping himſelf in the dark, his ſhirt ſeemed to be all on fire, which ſurpriſed him very much. Upon examination, red ſpots were found upon his ſhirt; and the phyſician who was preſent perceived an urinous ſmell, though it had nothing in it of volatile alkali, but of the muriatic acid; the ſame, he ſays, that iſſues from cabbage much ſalted, and ſtrongly fermented.

Acta Cæſarienſa, vol. v. p. 334.

48. All theſe lights accounted for from electricity.

The eaſieſt method of accounting for all theſe kinds of lights, perhaps, is from electricity. If light conſiſts in a certain vibration of the electric fluid †, then it follows, that in whatever ſubſtances ſuch a vibration takes place, there light muſt appear, whether in putreſcent animal ſubſtances, ſea-water, phoſphorus, or any thing elſe. We know that the electric matter pervades all terreſtrial ſubſtances, and is very liable to be ſet in motion from cauſes of which we are ignorant. The action of the air by which putrefaction is produced may be one of theſe cauſes; and it can by no means appear ſurpriſing that the electric matter ſhould act in the bodies of living animals in ſuch a manner as to produce a permanent light, when we certainly know it acts in ſome of them ſo powerfully as to produce a ſhock ſimilar to that of a charged vial.——On this ſubject we ſhall only obſerve farther, that when this vibration becomes ſo powerful as to penetrate the ſolid ſubſtance of the body itſelf, the luminous body then becomes tranſparent, as in the milk mentioned in the former part of this article; but, when it is only ſuperficial, the body, though it emits light, is itſelf opaque.

† See *Electricity*.

Light from Diamonds. Among luminous bodies the diamond is to be reckoned; as ſome diamonds are known to ſhine in the dark. But on account of the feebleneſs of their ſplendor, it is neceſſary for the perſon who is to obſerve them, previouſly to ſtay in the dark at leaſt a quarter of an hour; that the pupil of the eye may be dilated and enlarged, and ſo rendered capable of receiving a larger quantity of the rays of light. M. du Fay has alſo obſerved, that the eyes ought to be ſhut for this time, or at leaſt one of them; and that, in that caſe, the light of the diamond is afterwards only ſeen by that eye which has been ſhut. Before the diamond is brought into the dark room, it muſt be expoſed to the ſun-ſhine, or at leaſt to the open day-light, to imbibe a ſufficient quantity of rays; and this is done in one minute, or even leſs; eight or ten ſeconds having been found to furniſh as much light as a ſtone is capable of receiving; and when brought into the dark, its light continues about twelve or thirteen minutes, weakening all the while by inſenſible degrees. It is very remarkable, that in bodies ſo extremely ſimilar to each other as diamonds are, ſome ſhould have this property of imbibing the ſun's rays, and ſhining in the dark, and that others ſhould not; yet ſo it is found to be by experiment, and the moſt nearly reſembling ſtones ſhall be found one to have this property, and another to be deſtitute of it; while many of the moſt diſſimilar have the property in common. There ſeems to be no rule, nor even the leaſt traces of any imperfect rule of judging, which diamonds have, and which have not this property; their natural brightneſs, their purity, their ſize, or their ſhape, contribute nothing to it; and all that has been yet diſcovered of the leaſt regularity among them, is, that all the yellow diamonds have this property. This may probably ariſe from their having more ſulphur in their compoſition, and therefore illuminating more readily, or emitting a more viſible flame. Light.

The burning of diamonds is a term uſed among the jewellers, for putting them into a fierce fire, as they frequently do, when they are fouled with brown, or yellow, or the like; this always diveſts them of their colour, without doing them the leaſt ſenſible injury. M. du Fay, having been informed of this common practice, formed a conjecture, that the difference of diamonds in their ſhining, or not ſhining in the dark, was owing to it; and that either all thoſe which had been burnt, or all thoſe which had not, were thoſe which alone ſhone in the dark. But this was found an erroneous conjecture; for two diamonds, one lucid in the dark, the other not, were both burnt, and afterwards both were found to retain the ſame properties they had before. It is not only the open ſunſhine, or open day-light, which gives to theſe diamonds the power of ſhining in the dark; they receive it in the ſame manner, even if laid under a glaſs, or plunged in water or in milk.

M. du Fay tried whether it was poſſible to make the diamond retain, for any longer time, the light it naturally parts with ſo ſoon; and found, that if the diamond, after being expoſed to the light, be covered with black wax, it will ſhine in the dark, as well ſix hours afterwards as at the time it was firſt impregnated with the light.

The imbibing light, in this manner, being ſo nice a property as not to be found in ſeveral diamonds, it was not to be ſuppoſed that it would be found in any other ſtones: accordingly, on trial, the ruby, the ſapphire, and the topaz, were found wholly deſtitute of it; and among a large number of rough emeralds, one only was found to poſſeſs it. Such is the ſtrange uncertainty of theſe accidents.

All the other leſs precious ſtones were tried, and found not to poſſeſs this property of imbibing light from the day-light or ſun-ſhine, but they all became luminous by the different means of heating or friction; with this difference, that ſome acquired it by one of theſe

Light. theſe methods, and others by the other; each being unaffected by that which gave the property to the other. The diamond becomes luminous by all theſe ways.

Beccarius alſo diſcovered, that diamonds have the property of the Bolognian phoſphorus, about the ſame time that it occurred to M. du Fay. *Com. Bonon.* vol. ii. p. 276. M. du Fay likewiſe obſerved, that the common topaz, when calcined, had all the properties of this phoſphorus; and purſuing the diſcovery, he found the ſame property, in a great degree, in the belemnites, gypſum, lime-ſtone, and marble: though he was obliged to diſſolve ſome very hard ſubſtances of this kind in acids, before calcination could produce this change in them; and with ſome ſubſtances he could not ſucceed even thus; eſpecially with flint-ſtones, river-ſand, jaſpers, agates, and rock-cryſtal.

Light from Plants. In Sweden a very curious phenomenon has been obſerved on certain flowers by M. Haggern, lecturer in natural hiſtory. One evening he perceived a faint flaſh of light repeatedly dart from a marigold. Surpriſed at ſuch an uncommon appearance, he reſolved to examine it with attention; and, to be aſſured it was no deception of the eye, he placed a man near him, with orders to make a ſignal at the moment when he obſerved the light. They both ſaw it conſtantly at the ſame moment.

The light was moſt brilliant on marigolds of an orange or flame colour; but ſcarcely viſible on pale ones.

The flaſh was frequently ſeen on the ſame flower two or three times in quick ſucceſſion; but more commonly at intervals of ſeveral minutes: and when ſeveral flowers in the ſame place emitted their light together, it could be obſerved at a conſiderable diſtance.

This phenomenon was remarked in the months of July and Auguſt at ſun-ſet, and for half an hour, when the atmoſphere was clear; but after a rainy day, or when the air was loaded with vapours, nothing of it was ſeen.

The following flowers emitted flaſhes, more or leſs vivid, in this order:

1. The marigold, *galendula officinalis.*
2. Monk's-hood, *tropælum majus.*
3. The orange-lily, *lilium bulbiferum.*
4. The Indian pink, *tagetes patula & erecta.*

To diſcover whether ſome little inſects or phoſphoric worms might not be the cauſe of it, the flowers were carefully examined, even with a microſcope, without any ſuch being found.

From the rapidity of the flaſh, and other circumſtances, it may be conjectured that there is ſomething of electricity in this phenomenon. It is well known, that when the piſtil of a flower is impregnated, the pollen burſts away by its elaſticity, with which electricity may be combined. But M. Haggern, after having obſerved the flaſh from the orange lily, the antheræ of which are a conſiderable ſpace diſtant from the petals, found that the light proceeded from the petals only; whence he concludes, that this electric light is cauſed by the pollen, which, in flying off, is ſcattered on the petals. Whatever be the cauſe, the effect is ſingular and highly curious.

Lights, in painting, are thoſe parts of a piece which are illuminated, or that lie open to the luminary, by which the piece is ſuppoſed to be enlightened; and which, for this reaſon, are painted in bright vivid colours. Light ‖ Lightfoot.

In this ſenſe, light is oppoſed to ſhadow.

Different lights have very different effects on a picture, and occaſion a difference in the management of every part. A great deal therefore depends on the painter's chooſing a proper light for his piece to be illuminated by; and a great deal more, in the conduct of the lights and ſhadows, when the luminary is pitched upon.

The ſtrength and relievo of a figure, as well as its gracefulneſs, depend entirely on the management of the lights, and the joining of thoſe to the ſhadows.

The light a figure receives is either direct or reflected; to each of which ſpecial regard muſt be had. The doctrine of lights and ſhadows makes that part of painting called *chair obſcure.*

Light-Horſe, an ancient term in our Engliſh cuſtoms, ſignifying an ordinary cavalier or horſeman lightly armed, and ſo as to enter a corps or regiment; in oppoſition to the men at arms, who were heavily accoutred, and armed at all points. See *Light-Horse.*

Light-Houſe, a building erected upon a cape or promontory on the ſea-coaſt, or upon ſome rock in the ſea, and having on its top in the night-time a great fire, or light formed by candles, which is conſtantly attended by ſome careful perſon, ſo as to be ſeen at a great diſtance from the land. It is uſed to direct the ſhipping on the coaſt, that might otherwiſe run aſhore, or ſteer an improper courſe when the darkneſs of the night and the uncertainty of currents, &c. might render their ſituation with regard to the ſhore extremely doubtful. Lamp-lights are, on many accounts, preferable to coal-fires or candles; and the effect of theſe may be increaſed by placing them either behind glaſs-hemiſpheres, or before properly diſpoſed glaſs or metal reflectors, which laſt method is now very generally adopted. See Beacons.

Light-Room, a ſmall apartment, incloſed with glaſs-windows, near the magazine of a ſhip of war. It is uſed to contain the lights by which the gunner and his aſſiſtants are enabled to fill cartridges with powder to be ready for action.

LIGHTER, a large, open, flat-bottomed veſſel, generally managed with oars, and employed to carry goods to or from a ſhip when ſhe is to be laden or delivered.—There are alſo ſome lighters furniſhed with a deck throughout their whole length, in order to contain thoſe merchandiſes which would be damaged by rainy weather: theſe are uſually called *cloſe lighters.*

LIGHTFOOT (John), a moſt learned Engliſh divine, was the ſon of a divine, and born in March 1602, at Stoke upon Trent in Staffordſhire. After having finiſhed his ſtudies at a ſchool on Morton-green near Congleton in Cheſhire, he was removed in 1617 to Cambridge, where he applied himſelf to eloquence, and ſucceeded ſo well in it as to be thought the beſt orator of the under-graduates in the univerſity. He alſo made an extraordinary proficiency in the Latin and Greek; but neglected the Hebrew, and even loſt that knowledge he brought of it from ſchool. His taſte for the oriental languages was not yet excited; and as for logic, the ſtudy of it, as managed at that time among the academics, was too quarrelſome and fierce

Lightfoot. fierce for his quiet and meek diſpoſition. As ſoon as he had taken the degree of B. A. he left the univerſity, and became aſſiſtant to a ſchool at Repton in Derbyſhire. After he had ſupplied this place a year or two, he entered into orders, and became curate of Norton under Hales in Shropſhire. This curacy gave an occaſion of awakening his genius for the Hebrew tongue. Norton lies near Bellaport, then the ſeat of Sir Rowland Cotton; who was his conſtant hearer, made him his chaplain, and took him into his houſe. This gentleman being a perfect maſter of the Hebrew language, engaged Lightfoot in that ſtudy; who, by converſing with his patron, ſoon became ſenſible that without that knowledge it was impoſſible to attain an accurate underſtanding of the ſcriptures. He therefore applied himſelf to it with extraordinary vigour, and in a little time made a great progreſs in it: and his patron removing with his family to reſide in London, at the requeſt of Sir Alland Cotton his uncle, who was lord-mayor of that city, he followed his preceptor thither. But he did not ſtay long there: for, having a mind to improve himſelf by travelling abroad, he went down into Staffordſhire to take leave of his father and mother. Paſſing through Stone in that county, he found the place deſtitute of a miniſter: and the preſſing inſtances of the pariſhioners prevailed upon him to undertake that cure. Hereupon, laying aſide his deſign of travelling abroad, he began to turn his thoughts upon ſettling at home. During his reſidence at Bellaport, he had fallen into the acquaintance of a gentlewoman who was daughter of William Crompton of Stonepark, Eſq; and now, being in poſſeſſion of that living, he married her in 1628. But notwithſtanding this ſettlement, his unquenchable thirſt after rabbinical learning would not ſuffer him to continue there. Sion-college library at London, he knew, was well ſtocked with books of that kind. He therefore quitted his charge at Stone, and removed with his family to Hornſey, near the city; where he gave the public a notable ſpecimen of his advancement in thoſe ſtudies, by his "Erubhim, or Miſcellanies Chriſtian and Judaical," in 1629. He was at this time only 27 years of age; and appears to have been well acquainted with the Latin and the Geeek fathers, as well as the ancient heathen writers. Theſe firſt fruits of his ſtudies were dedicated to Sir Rowland Cotton; who, in 1631, preſented him to the rectory of Aſhley in Staffordſhire.

He ſeemed now to be fixed for life: Accordingly, he built a ſtudy in the garden, to be out of the noiſe of the houſe; and applied himſelf with indefatigable diligence in ſearching the ſcriptures. Thus employed, the days paſſed very agreeably; and he continued quiet and unmoleſted, till the great change which happened in the public affairs brought him into a ſhare of the adminiſtration relating to the church; for he was nominated a member of the memorable aſſembly of divines for ſettling a new form of eccleſiaſtical polity. This appointment was purely the effect of his diſtinguiſhed merit; and he accepted it purely with a view to ſerve his country, as far as lay in his power. The non-reſidence, which this would neceſſarily occaſion, apparently induced him to reſign his rectory: and having obtained the preſentation for a younger brother, he ſet out for London in 1642. He had now ſatisfied himſelf in clearing up many of the abſtruſeſt paſſages in the Bible, and therein had provided the chief materials, as well as formed the plan, of his "Harmony;" and an opportunity of inſpecting it at the preſs was, no doubt, an additional motive for his going to the capital; where he had not been long before he was choſen miniſter of St Bartholomew's, behind the Royal Exchange. The aſſembly of divines meeting in 1643, our author gave his attendance diligently there, and made a diſtinguiſhed figure in their debates; where he uſed great freedom, and gave ſignal proofs of his courage as well as learning, in oppoſing many of thoſe tenets which the divines were endeavouring to eſtabliſh. His learning recommended him to the parliament, whoſe viſitors, having ejected Dr William Spurſtow from the maſterſhip of Catharine-hall in Cambridge, put Lightfoot in his room, this year 1653; and he was alſo preſented to the living of Much-Munden in Hertfordſhire, void by the death of Dr Samuel Ward, Margaret-profeſſor of divinity in that univerſity, before the expiration of this year. Meanwhile he had his turn with other favourites in preaching before the houſe of commons, moſt of which ſermons were printed; and in them we ſee him warmly preſſing the ſpeedy ſettlement of the church in the Preſbyterian form, which he cordially believed to be according to the pattern in the Mount. He was all the while employed in preparing and publiſhing the ſeveral branches of his Harmony; all which were ſo many excellent ſpecimens of the uſefulneſs of human learning to true religion: and he met with great difficulties and diſcouragements in that work, chiefly from that antieruditional ſpirit which prevailed, and even threatened the deſtruction of the univerſities. In 1655 he entered upon the office of vice-chancellor of Cambridge, to which he was choſen that year, having taken the degree of doctor of divinity in 1652. He performed all the regular exerciſes for his degree with great applauſe, and executed the vice-chancellor's office with exemplary diligence and fidelity; and, particularly at the commencement, ſupplied the place of profeſſor of divinity, then undiſpoſed of, as an act which was kept for a doctor's degree in that profeſſion. At the ſame time he was engaged with others in perfecting the Polyglott Bible, then in the preſs. At the Reſtoration he offered to reſign the maſterſhip of Catharine-hall: But, as what he had done had been rather in compliance with the neceſſity of the times, than from any zeal or ſpirit of oppoſition to the king and government, a confirmation was granted him from the crown, both of the place and of his living. Soon after this he was appointed one of the aſſiſtants at the conference upon the liturgy, which was held in the beginning of 1661, but attended only once or twice; probably diſguſted at the heat with which that conference was managed. However, he ſtuck cloſe to his deſign of perfecting his Harmony: and being of a ſtrong and healthy conſtitution, which was aſſiſted by an exact temperance, he proſecuted his ſtudies with unabated vigour to the laſt, and continued to publiſh, notwithſtanding the many difficulties he met with from the expence of it. However, not long before he died, ſome bookſellers got a promiſe from him to collect and methodize his works, in order to print them; but the execution was prevented by his death, which happened Dec. 6. 1675. The doctor was twice married: his Lightfoot.

firſt

Lightning. first wife, already mentioned, brought him four ſons and two daughters. His ſecond wife was likewiſe a widow, and relict of Mr Auſtin Brograve, uncle of Sir Thomas Brograve, Bart. of Hertfordſhire, a gentleman well verſed in rabbinical learning, and a particular acquaintance of our author. He had no iſſue by her. She alſo died before him, and was buried in Munden church; where the doctor was himſelf likewiſe interred near both his wives. Dr Lightfoot's works were collected and publiſhed firſt in 1684, in two volumes folio. The ſecond edition was printed at Amſterdam, 1686, in two volumes folio, containing all his Latin writings, with a Latin tranſlation of thoſe which he wrote in Engliſh. At the end of both theſe editions there is a liſt of ſuch pieces as he left unfiniſhed. It is the chief of theſe, in Latin, which make up the third volume, added to the former two, in a third edition of his works, by John Leuſden, at Utrecht, in 1699, fol. They were communicated by Mr Strype, who, in 1700, publiſhed another collection of theſe papers, under the title of "Some genuine remains of the late pious and learned Dr John Lightfoot.

LIGHTNING, a bright and vivid flaſh of fire, ſuddenly appearing in the atmoſphere, and commonly diſappearing in an inſtant, ſometimes attended with clouds and thunder, and ſometimes not.

1 Different appearances of lightning.

The phenomena of lightning are always ſurpriſing, and ſometimes very terrible; neither is there any kind of natural appearance in which there is more diverſity, not two flaſhes being ever obſerved exactly ſimilar to one another. In a ſerene ſky, the lightning, in this country at leaſt, almoſt always hath a kind of indiſtinct appearance without any determinate form, like the ſudden illumination of the atmoſphere occaſioned by firing a quantity of looſe gunpowder; but when accompanied with thunder, it is well defined, and hath very often a zig-zag form. Sometimes it makes only one angle, like the letter V, ſometimes it hath ſeveral branches, and ſometimes it appears like the arch of a circle. But the moſt formidable and deſtructive form which lightning is ever known to aſſume is that of balls of fire. The motion of theſe is very often eaſily perceptible to the eye; but wherever they fall, much miſchief is occaſioned by their burſting, which they always do with a ſudden exploſion like that of fire-arms. Sometimes they will quietly run along, or reſt for a little upon any thing, and then break into ſeveral pieces, each of which will explode; or the whole ball will burſt at once, and produce its miſchievous effects only in one place. The next to this in its deſtructive effects is the zig-zag kind; for that which appears like indiſtinct flaſhes, whoſe form cannot be readily obſerved, is ſeldom or never known to do hurt.—The colour of the lightning alſo indicates in ſome meaſure its power to do miſchief; the paleſt and brighteſt flaſhes being moſt deſtructive; ſuch as are red, or of a darker colour, commonly doing leſs damage.

2 Its ſeeming omnipreſence.

A very ſurpriſing property of lightning, the zig-zag kind eſpecially when near, is its ſeeming omnipreſence. If two perſons are ſtanding in a room looking different ways, and a loud clap of thunder accompanied with zig-zag lightning happens, they will both diſtinctly ſee the flaſh, not only by that indiſtinct illumination of the atmoſphere which is occaſioned by fire of any kind; but the very form of the lightning itſelf, and every angle it makes in its courſe, will be as diſtinctly perceptible, as though they had looked directly at the cloud from whence it proceeded. If a perſon happened at that time to be looking on a book, or other object which he held in his hand, he would diſtinctly ſee the form of the lightning between him and the object at which he looked. This property ſeems peculiar to lightning, and to belong to no other kind of fire whatever. Lightning.

3 Remarkable effects of lightning.

The effects of lightning are generally confined within a ſmall ſpace; and are ſeldom ſimilar to thoſe which accompany exploſions of gun-powder, or of inflammable air in mines. Inſtances of this kind, however, have occurred; the following is one of the moſt remarkable of which we have any diſtinct account. "Auguſt 2. 1763, about ſix in the evening, there aroſe at Anderlight, about a league from Bruſſels, a conflict of ſeveral winds borne upon a thick fog. This conflict laſted four or five minutes, and was attended with a frightful hiſſing noiſe, which could be compared to nothing but the yellings of an infinite number of wild beaſts. The cloud then opening, diſcovered a kind of very bright lightning, and in an inſtant the roofs of one ſide of the houſes were carried off and diſperſed at a diſtance; above 1000 large trees were broke off, ſome near the ground, others near the top, ſome torn up by the roots; and many both of the branches and tops carried to the diſtance of 60, 100, or 120 paces; whole coppices were laid on one ſide, as corn is by ordinary winds. The glaſs of the windows which were moſt expoſed was ſhivered to pieces. A tent in a gentleman's garden was carried to the diſtance of 4000 paces; and a branch torn from a large tree, ſtruck a girl in the forehead as ſhe was coming into town, at the diſtance of 40 paces from the trunk of the tree, and killed her on the ſpot."

Theſe terrible effects ſeem to have been owing to the prodigious agitation in the air, occaſioned by the emiſſion of ſuch a vaſt quantity of lightning at once; or perhaps to the agitation of the electric fluid itſelf, which is ſtill more dangerous than any concuſſion of the atmoſphere; for thunder-ſtorms will ſometimes produce moſt violent whirlwinds, ſuch as are by the beſt philoſophers attributed to electricity, nay, even occaſion an agitation of the waters of the ocean itſelf; and all this too after the thunder and lightning had ceaſed.—Of this we have the following inſtances. "Great Malvern, October 16. 1761. On Wedneſday laſt, we had the moſt violent thunder ever known in the memory of man. At a quarter paſt four in the afternoon I was ſurpriſed with a moſt ſhocking and diſmal noiſe; 100 forges (the neareſt reſemblance I can think of), were they all at work at once, could ſcarce equal it. I ran to the fore-door, and caſting my eye upon the ſide of the hill about 400 yards to the ſouth-weſt of my houſe, there appeared a prodigious ſmoke, attended with the ſame violent noiſe. I ran back into the houſe, and cried out, a volcano (for ſo I thought) had burſt out of the hill; but I had no ſooner got back again, than I found it had deſcended, and was paſſing on within about 100 yards of the ſouth end of my houſe. It ſeemed to riſe again in the meadow juſt below it; and con-

Lightning. continued its progreſs to the eaſt, riſing in the ſame manner for four different times, attended with the ſame diſmal noiſe as at firſt; the air being filled with a nauſeous and ſulphureous ſmell. I ſaw it gradually decreaſe till quite extinguiſhed in a turnip-field about a quarter of a mile below my houſe. The turnip leaves, with leaves of trees, dirt, ſticks, &c. filled the air, and flew higher than any of theſe hills. The thunder ceaſed before this happened, and the air ſoon afterwards became calm and ſerene."—The vaſt column of ſmoke mentioned in the above letter was ſo large, that a phyſician of eminence at Worceſter ſaw it in its progreſs down the hill, about a mile from Feckenham, which is above 20 miles from Malvern.—In Auguſt 1763, a moſt violent ſtorm of thunder, rain, and hail, happened at London, which did damage in the adjacent country, to the amount of 50,000 l. Hailſtones fell of an immenſe ſize, from two to ten inches circumference; but the moſt ſurpriſing circumſtance was the ſudden flux and reflux of the tide in Plymouth pool, exactly correſponding with the like agitation in the ſame place, at the time of the great earthquake at Liſbon.

Inſtances are alſo to be found, where lightning, by its own proper force, without any aſſiſtance from thoſe leſs common agitations of the atmoſphere or electric fluid, hath thrown ſtones of immenſe weight to conſiderable diſtances; torn up trees by the root, and broke them in pieces; ſhattered rocks; beat down houſes, and ſet them on fire, &c.

Extraordinary effects of lightning on a pyed bullock.

A very ſingular effect of lightning is mentioned in the 66th volume of the Philoſophical Tranſactions, upon a pyed bullock. It happened in the county of Suſſex about the end of Auguſt 1774. The bullock was white and red; and the lightning ſtripped off the white hair leaving the red untouched. The following is a particular account of the matter. "In the evening of Sunday, the 28th of Auguſt, there was an appearance of a thunder-ſtorm, but we heard no report. A gentleman who was riding near the marſhes not far diſtant from this town (Lewes) ſaw two ſtrong flaſhes of lightning, ſeemingly running along the ground of the marſh, at about nine o'clock in the evening. On Monday morning, when the ſervants of Mr Roger, a farmer at Swanborough, in the pariſh of Iford, went into the marſh to fetch the oxen to their work, they found one of them, a four-year-old ſteer, ſtanding up to appearance much burnt, and ſo weak as to be ſcarce able to walk. The animal ſeemed to have been ſtruck by lightning in a very extraordinary manner. He is of a white and red colour; the white in large marks, beginning at the rump bone, and running in various directions along both the ſides; the belly is all white, and the whole head and horns white likewiſe. The lightning, with which he muſt have been undoubtedly ſtruck, fell upon the rump bone, which is white, and diſtributed itſelf along the ſides in ſuch a manner as to take off all the hair from the white marks as low as the bottom of the ribs, but ſo as to leave a liſt of white hair, about half an inch broad, all round where it joined to the red, and not a ſingle hair of the red appears to be touched. The whole belly is unhurt, but the end of the ſheath of the penis has the hair taken off; it is alſo taken off from the dewlap: the horns and the curled hair on the forehead are uninjured; but the hair is taken off from the ſides of the face, from the flat part of the jaw-bones, and from the front of the face in ſtripes. There are a few white marks on the ſide and neck, which are ſurrounded with red; and the hair is taken off from them, leaving half an inch of white adjoining to the red. The farmer anointed the ox with oil for a fortnight; the animal purged very much at firſt, and was greatly reduced in fleſh, but is now recovering."

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In another account of this accident, the author ſuppoſes that the bullock had been lying down at the time he was ſtruck; which ſhows the reaſon that the under parts were not touched. "The lightning, conducted by the white hair, from the top of the back down the ſides, came to the ground at the place where the white hair was left entire."

The author of this account ſays, that he inquired of a Mr Tooth a farrier, whether he ever knew of a ſimilar accident; and that he told him "the circumſtance was not new to him; that he had ſeen a great many pyed bullocks ſtruck by lightning in the ſame manner as this; that the texture of the ſkin under the white hair was always deſtroyed, though looking fair at firſt; but after a while it became ſore, throwing out a putrid matter in puſtules, like the ſmall-pox with us, which in time falls off, when the hair grows again, and the bullocks receive no farther injury;" which was the caſe with the bullock in queſtion. In a ſubſequent letter, however, the very ſame author informs us, that he had inquired of Mr Tooth "whether he ever ſaw a ſtroke of lightning actually fall upon a pyed bullock, ſo as to deſtroy the white hair, and ſhow evident marks of burning, leaving the red hair uninjured? He ſaid he never did; nor did he recollect any one that had. He gave an account, however, of a pyed *horſe*, belonging to himſelf, which had been ſtruck dead by lightning in the night-time." The exploſion was ſo violent, that Mr Tooth imagined his houſe had been ſtruck, and therefore immediately got up. On going into the ſtable he found the horſe almoſt dead to appearance, though it kept on its legs near half an hour before it expired. The horſe was pyed white on the ſhoulder and greateſt part of the head; *viz.* the forehead and noſe, where the greateſt force of the ſtroke came. "The hair was not burnt nor diſcoloured, only ſo looſened at the root, that it came off with the leaſt touch. And this is the caſe, according to Mr Tooth's obſervation, with all that he has ſeen or heard of; *viz.* the hair is never burnt, but the ſkin always affected as above mentioned. In the horſe, all the blood in the veins under the white parts of the head was quite ſtagnated, though he could perceive it to flow in other parts as uſual; and the ſkin, together with one ſide of the tongue, was parched and dried up to a greater degree than he had ever ſeen before."

5 On a pyed horſe.

Another inſtance is mentioned of this extraordinary effect of lightning upon a bullock, in which even the ſmall red ſpots on the ſides were unaffected; and in this, as well as the former, the white hair on the under part of the belly, and on the legs, was left untouched.

All theſe, however, are to be conſidered as the more unuſual phenomena of lightning; its common mode of action being entirely ſimilar to that of a charged Leyden vial, where the electric matter diſcharges

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itſelf from a ſubſtance poſitively electrified to one that is negatively ſo. The indentity of electric matter and lightning ſeems now, indeed, ſo well eſtabliſhed, that there is not the leaſt foundation for ſeeking any other ſolution of the phenomena of lightning, than what may be obtained by comparing them with thoſe of our electrical experiments. The different forms of the flaſhes are all exemplified in thoſe of electrical ſparks. Where the quantity of electricity is ſmall, and conſequently incapable of ſtriking at any conſiderable diſtance, the ſpark appears ſtraight, without any curvature or angular appearance: but where the electricity is very ſtrong, and of conſequence capable of ſtriking an object at a pretty conſiderable diſtance, it aſſumes a crooked or zig-zag form. This is always the caſe with Mr Nairn's very powerful machines, the conductors of which are ſix feet in length and one foot in diameter. Sparks may be taken from them at the diſtance of 16, 17, or even 20 inches; and all of theſe put on the angular zig-zag form of lightning. The reaſon of this appearance, both in theſe ſparks and in the lightning, is, that the more fluid electric matter hath to paſs through the denſer and leſs fluid atmoſphere with great rapidity; and in fact, this is the way in which all the more fluid ſubſtances paſs through thoſe that are leſs ſo, at leaſt when their velocity becomes conſiderable. If bubbles of air or ſteam paſs very gently up through water, their courſe from the bottom to the top of the veſſel will differ very little, if at all, from a ſtraight line; but when they are impelled by a conſiderable force, as in air blown from a bellows, or the bubbles of ſteam which ariſe in boiling water, their courſe is then marked by waved and crooked lines, and the deflection of the bubbles to the right or left will be preciſely in proportion to their aſcending velocity, and to the weight of the water by which they are reſiſted.

6 Similarity between electric ſparks and lightning.

7 Why it aſſumes a zig-zag form.

In the caſe of air blown through water, however, or ſteam aſcending from the bottom of a veſſel of boiling water, though the courſe of the bubbles is waved and crooked, we never obſerve it to be angular as in lightning. The reaſon of this is, that there is no proportion between the capacity of the air for yielding to the impetus of lightning, and the velocity with which the latter is moved. From Mr Robins's experiments in gunnery, it appears, that the air cannot yield with a velocity much greater than 1200 feet in a ſecond, and that all projectiles moving with a greater degree of velocity meet with a violent reſiſtance. But if we ſuppoſe lightning to move only with one half the velocity of light, that is, near 100,000 miles in a ſecond, or even with that of 1000 miles in a minute, which moſt probably is the caſe*, its motion in the fluid atmoſphere will meet with a reſiſtance very little inferior to what air would meet with in paſſing through the moſt ſolid bodies. The ſmalleſt difference of the reſiſtance of the atmoſphere on either ſide, muſt determine the lightning to that ſide; and in its paſſage to that new place where the reſiſtance is leaſt, it muſt paſs on in a ſtraight line, making an angle with its former courſe, becauſe the atmoſphere is altogether incapable of yielding with ſuch rapidity as the electric matter requires, and therefore reſiſts like a ſolid rock. The caſe is otherwiſe in the former examples: for tho' a ſmall difference in the reſiſtance forces the bubbles of air or ſteam to deviate from ſide to ſide, yet there is always a conſiderable proportion between the capacity of water for yielding, and that force by which the bubbles urge it to yield; ſo that though it does make a reſiſtance ſufficient to prevent the bubbles from moving in a ſtraight line, yet it alſo perceptibly yields at all times, and therefore the tract of the bubbles is formed by a number of curves and not angles.

* See *Fire-ball.*

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8 Why ſuch kind of lightning is very dangerous.

Hence we may underſtand the reaſon why the zig-zag kind of lightning is ſo dangerous, namely, becauſe it muſt overcome a very violent reſiſtance of the atmoſphere; and wherever that reſiſtance is in the ſmalleſt degree leſſened, there it will undoubtedly ſtrike, and at a very conſiderable diſtance too. It is otherwiſe with that kind which appears in flaſhes of no determinate form. The electric matter of which theſe are compoſed, is evidently diſſipated in the air by ſome conducting ſubſtances which are preſent there; and of conſequence, though a man, or other conducting body, happened to be very near ſuch a flaſh, he would not be ſtruck or materially injured by it, though a zig-zag flaſh, in ſuch circumſtances, would have probably diſcharged its whole force upon him.

9 Why lightning aſſumes the form of balls.

The moſt deſtructive kind of lightning, however, as we have already obſerved, is that which aſſumes the form of balls. Theſe are produced by an exceeding great power of electricity gradually accumulated till the reſiſtance of the atmoſphere is no longer able to confine it. In general, the lightning breaks out from the electrified cloud by means of the approach of ſome conducting ſubſtance; either a cloud, or ſome terreſtrial ſubſtance: but the fire-balls ſeem to be formed, not becauſe there is any ſubſtance at hand to attract the electric matter from the cloud, but becauſe the electricity is accumulated in ſuch quantity that the cloud itſelf can no longer contain it. Hence ſuch balls fly off ſlowly, and have no particular deſtination. Their appearance indicates a prodigious commotion and accumulation of electricity in the atmoſphere, without a proportionable diſpoſition in the earth to receive it. This diſpoſition, however, we know, is perpetually altered by a thouſand circumſtances, and the place which firſt becomes moſt capable of admitting electricity will certainly receive a fire-ball. Hence this kind of lightning has been known to move ſlowly backwards and forwards in the air for a conſiderable ſpace of time, and then ſuddenly to fall on one or more houſes, according to their being more or leſs affected with an electricity oppoſite to that of the ball at the time. It will alſo run along the ground, break into ſeveral parts, and produce ſeveral exploſions at the ſame time.

It is very difficult to imitate lightning of this kind in our electrical experiments. The only caſes in which it hath been done in any degree are thoſe in which Dr Prieſtley made the exploſion of a battery paſs for a conſiderable way over the ſurface of raw fleſh, water, &c. and in Mr Arden's experiment, when a fire-ball aſcended to the top of an electrified jar, and burſt it with a violent exploſion. See ELECTRICITY n° 89, &c. In theſe caſes, if, while the electric flaſh paſſed over the ſurface of the fleſh, it had been poſſible to interrupt the metallic circuit by taking away the chain, the electric matter diſcharged from the battery would have been preciſely in the ſituation of one of the fire-

balls

Lightning. balls above-mentioned; *i. e.* it would have been at a loſs for a conductor. The negative ſide of the battery was the place of its deſtination; but to that it would not have eaſily got, becauſe of the great quantity of atmoſphere which lay in its way, and the incapacity of the neighbouring bodies to receive it. But, while the electric matter was thus ſtationary for want of a conductor, if any perſon ſtanding near, or touching the negative ſide of the battery, preſented a finger to that ſeemingly inoffenſive luminous body, he would inſtantly be ſtruck very violently; becauſe a free communication being now made by means of his body, the powers by which the electric fluid is impelled from one place to another would inſtantly urge it upon him. But if we ſuppoſe a perſon, who hath no communication with the battery, to preſent his finger to the ſame body, he may perhaps receive a ſlight ſpark from it; but not a ſhock of any conſequence, becauſe there is not a perfect communication by means of his body with the place to which the electric fire is deſtined.

10 Phenomena of lightning in general accounted for.

Hence we may account for the ſeemingly capricious nature of lightning of all kinds, but eſpecially of that kind which appears in the form of balls. Sometimes it will ſtrike trees, high houſes, ſteeples, and towers, without touching cottages, men, or other animals, who are in the neighbourhood. In ſuch caſes, people would be apt to ſay that the neighbourhood of theſe higher objects *preſerved* the others from the ſtroke; but with little reaſon, ſince low houſes, men walking in the fields, cattle, nay the ſurface of the earth itſelf, have all been ſtruck, while high trees and ſteeples in the neighbourhood have not been touched. In like manner, fire-balls have paſſed very near certain perſons without hurting them, while they have, as it were, gone conſiderably out of their way to kill others. The reaſon of all this is, that in thunder-ſtorms there is conſtantly a certain zone of earth conſiderably under the ſurface, which the lightning deſires (if we may uſe the expreſſion) to ſtrike, becauſe it hath an electricity oppoſite to that of the lightning itſelf. Thoſe objects, therefore, which form the moſt perfect conductors between the electrified clouds and that zone of earth, will be ſtruck by the lightning, whether they are high or low; and becauſe we know not the conducting quality of the different terreſtrial ſubſtances, the ſuperſtitious are apt to aſcribe ſtrokes of lightning to the divine vengeance againſt particular perſons, whereas it is certain that this fluid, as well as others, acts according to invariable rules from which it is never known to depart.

Lightning, in the time of ſevere thunder-ſtorms, is ſuppoſed to proceed from the earth, as well as from the clouds: but this fact hath never been well aſcertained, and indeed from the nature of the thing it ſeems very difficult to be aſcertained; for the motion of the electric fluid is ſo very quick, that it is altogether impoſſible to determine, by means of our ſenſes, whether it goes from the earth or comes to it. In fact, there are in this country many thunder ſtorms in which it doth not appear that the lightning touches any part of the earth, and conſequently can neither go to it nor come out from it. In theſe caſes, it flaſhes either from an electrified cloud to one endowed with an oppoſite electricity, or merely into thoſe parts of the atmoſphere which are ready to receive it. But if not only the clouds, but the atmoſphere all the way betwixt them and the earth, and likewiſe for a conſiderable ſpace above the clouds, are electrified one way, the earth muſt then be ſtruck. The reaſon of this will appear from a conſideration of the principles laid down under the article ELECTRICITY, ſect. vi. It there appears, that the electric fluid is altogether incapable either of *accumulation* or *diminution* in quantity in any particular part of ſpace. What we call *electricity* is only the motion of this fluid made perceptible to our ſenſes. Poſitive electricity is when the current of electric matter is directed from the electrified body. Negative electricity is when the current is directed towards it. Let us now ſuppoſe, that a poſitively electrified cloud is formed over a certain part of the earth's ſurface. The electric matter flows out from it firſt into the atmoſphere all round; and while it is doing ſo, the atmoſphere is negatively electrified. In proportion, however, as the electric current pervades greater and greater portions of the atmoſpherical ſpace, the greater is the reſiſtance to its motion, till at laſt the air becomes poſitively electrified as well as the cloud, and then both act together as one body. The ſurface of the earth then begins to be affected, and it ſilently receives the electric matter by means of the trees, graſs, &c. till at laſt it becomes poſitively electrified alſo, and begins to ſend off a current of electricity from the ſurface downwards. The cauſes which at firſt produced the electricity of the clouds (and which are treated of under the article THUNDER), ſtill continuing to act, the power of the electric current becomes inconceivably great. The danger of the thunder-ſtorm now begins; for as the force of the lightning is directed to ſome place below the ſurface of the earth, it will certainly dart towards that place, and ſhatter every thing to pieces which reſiſts its paſſage. The benefit of conducting-rods will now alſo be evident: for we are ſure that the electric matter will in all caſes take the way where it meets with the leaſt reſiſtance; and this is through the ſubſtance, or rather over the ſurface, of metals. In ſuch a caſe, therefore, if there happen to be a houſe furniſhed with a conductor directly below the cloud, and at the ſame time a zone of negatively electrified earth not very far below the foundation of the houſe, the conductor will almoſt certainly be ſtruck, but the building will be unhurt. If the houſe wants a conductor, the lightning will nevertheleſs ſtrike in the ſame place, in order to get at the negatively electrified zone above mentioned; but the building will now be damaged, becauſe the materials of it cannot readily conduct the electric fluid.

11 Uſe of conducting rods.

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12 Whether knobbed or pointed conductors are preferable.

We will now be able to enter into the diſpute, Whether the preference is due to knobbed or pointed conductors for preſerving buildings from ſtrokes of lightning? Ever ſince the diſcovery of the identity of electricity and lightning, it hath been allowed by all parties, that conductors of ſome kind are in a manner eſſentially neceſſary for the ſafety of buildings in thoſe countries where thunder-ſtorms are very frequent. The principle on which they act hath been already explained; namely, that the electric fluid, when impelled by any power, always goes to that place where

Lightning. it meets with the leaſt reſiſtance, as all other fluids alſo do. As metals, therefore, are found to give the leaſt reſiſtance to its paſſage, it will always chooſe to run along a metalline rod, in preference to a paſſage of any other kind. We muſt, however, carefully conſider a circumſtance which ſeems to have been too much overlooked by electricians in their reaſonings concerning the effects of thunder-rods; namely, That lightning, or electricity, never ſtrikes a body, merely for the ſake of the body itſelf, but only becauſe by means of that body it can readily arrive at the place of its deſtination. When a quantity of electricity is collected from the earth, by means of an electric machine, a body communicating with the earth will receive a ſtrong ſpark from the prime conductor. The body receives this ſpark, not becauſe it is itſelf capable of containing all the electricity of the conductor and cylinder, but becauſe the natural ſituation of the fluid being diſturbed by the motion of the machine, a ſtream of it is ſent off from the earth. The natural powers, therefore, make an effort to ſupply what is thus drained off from the earth; and as the individual quantity which comes out is moſt proper for ſupplying the deficiency, as not being employed in any natural purpoſe, there is always an effort made for returning it to the earth. No ſooner, then, is a conducting body, communicating with the earth, preſented to the electrical machine, than the whole effort of the electricity is directed againſt that body, not merely becauſe it is a conductor, but becauſe it leads to the place where the fluid is directed by the natural powers by which it is governed, and at which it would find other means to arrive, though that body were not to be preſented. That this is the caſe, we may very eaſily ſatisfy ourſelves, by preſenting the very ſame conducting ſubſtance in an inſulated ſtate to the prime conductor of the machine; for then we ſhall find, that only a very ſmall ſpark will be produced. In like manner, when lightning ſtrikes a tree, a houſe, or a thunder-rod, it is not becauſe theſe objects are high, or in the neighbourhood of the cloud; but becauſe they communicate with ſome place below the ſurface of the ground, againſt which the impetus of the lightning is directed; and at that place the lightning would certainly arrive, though none of the abovementioned objects had been interpoſed.

The fallacy of that kind of reaſoning generally employed concerning the uſe of thunder-rods, will now be ſufficiently apparent. Becauſe a point preſented to an electrified body in our experiments, always draws off the electricity in a ſilent manner; therefore Dr Franklin and his followers have concluded, that a pointed conductor will do the ſame thing to a thunder-cloud, and thus effectually prevent any kind of danger from a ſtroke of lightning. Their reaſoning on this ſubject, they think, is confirmed by the following fact among many others. "Dr Franklin's houſe at Philadelphia was furniſhed with a rod extending nine feet above the top of the chimney. To this rod was connected a wire of the thickneſs of a gooſe-quill, which deſcended through the wall of the ſtair-caſe; where an interruption was made, ſo that the ends of the wire, to each of which a little bell was fixed, were diſtant from each other about ſix inches; an inſulated braſs ball hanging between the two bells. The author was Lightning. one night waked by loud cracks, proceeding from his apparatus in the ſtair-caſe. He perceived, that the braſs ball, inſtead of vibrating as uſual between the bells, was repelled and kept at a diſtance from both; while the fire ſometimes paſſed in very large quick cracks directly from bell to bell; and ſometimes in a continued denſe white ſtream, ſeemingly as large as his finger; by means of which the whole ſtair-caſe was enlightened, as with ſun-ſhine, ſo that he could ſee to pick up a pin.—From the apparent quantity of electric matter of which the cloud was thus evidently robbed, by means of the pointed rod (and of which a blunt conductor would not have deprived it), the author conceives, that a number of ſuch conductors muſt conſiderably leſſen the quantity of electric fluid contained in any approaching cloud, before it comes ſo near as to deliver its contents in a general ſtroke."

For this very reaſon, Mr Benjamin Wilſon and his followers, who conſtitute the oppoſite party, have determined that the uſe of pointed conductors is utterly unſafe. They ſay, that in violent thunder ſtorms the whole atmoſphere is full of electricity; and that attempts to exhauſt the vaſt quantity there collected, are like attempting to clear away an inundation with a ſhovel, or to exhauſt the atmoſphere with a pair of bellows. They maintain, that though pointed bodies will effectually prevent the accumulation of electricity in any ſubſtance; yet if a non-electrified body is interpoſed between a point and the conductor of an electrical machine, the point will be ſtruck at the ſame moment with the non-electrified body, and at a much greater diſtance than that at which a knob would be ſtruck. They affirm alſo, that, by means of this ſilent ſolicitation of the lightning, inflammable bodies, ſuch as gun-powder, tinder, and Kunckel's phoſphorus, may be ſet on fire; and for theſe laſt facts they bring deciſive experiments. From all this, ſay they, it is evident that the uſe of pointed conductors is unſafe. They ſolicit a diſcharge to the place where they are; and as they are unable to conduct the whole electricity in the atmoſphere, it is impoſſible for us to know whether the diſcharge they ſolicit may not be too great for our conductor to bear; and conſequently all the miſchiefs ariſing from thunder-ſtorms may be expected, with this additional and mortifying circumſtance, that this very conductor hath probably ſolicited the fatal ſtroke, when without it the cloud might have paſſed harmleſs over our heads without ſtriking at all.

Here the reaſoning of both parties ſeems equally wrong. They both proceed on this erroneous principle, That in thunder-ſtorms the conductor will always ſolicit a diſcharge, or that at ſuch times all the elevated objects on the ſurface of the earth are drawing off the electricity of the atmoſphere. But this cannot be the caſe, unleſs the electricity of the earth and of the atmoſphere is of a different kind. Now, it is demonſtrable, that until this difference between the electricity of the atmoſphere and of the ſurface of the earth ceaſes, there cannot be a thunder-ſtorm. When the atmoſphere begins to be electrified either poſitively or negatively, the earth, by means of the inequalities and moiſture of its ſurface, but eſpecially by the vegetables which

grow

Lightning. grow upon it, abſorbs that electricity, and quickly becomes electrified in the ſame manner with the atmoſphere. This abſorption, however, ceaſes in a very ſhort time, becauſe it cannot be continued without ſetting in motion the whole of the electric matter contained in the earth itſelf. Alternate zones of poſitive and negative electricity will then begin to take place below the ſurface of the earth, for the reaſons mentioned under the article ELECTRICITY, ſect. vi. § 9. Between the atmoſphere and one of theſe zones, the ſtroke of the lightning always will be. Thus ſuppoſing the atmoſphere is poſitively electrified, the ſurface of the earth will, by means of trees, &c. quickly become poſitively electrified alſo; we ſhall ſuppoſe to the depth of 10 feet. The electricity cannot penetrate farther on account of the reſiſtance of the electric matter in the bowels of the earth. At the depth of 10 feet from the ſurface, therefore, a zone of negatively electrified earth begins, and to this zone the electricity of the atmoſphere is attracted; but to this it cannot get, without breaking through the poſitively electrified zone which lies uppermoſt, and ſhattering to pieces every bad conductor which comes in its way. We are very ſure, therefore, that in whatever places the outer-zone of poſitively electrified earth is thinneſt, there the lightning will ſtrike, whether a conductor happens to be preſent or not. If there is a conductor, either knobbed or ſharp-pointed, the lightning will indeed infallibly ſtrike it; but it would alſo have ſtruck a houſe ſituated on that ſpot, without any conductor; and though the houſe had not been there, it would have ſtruck the ſurface of the ground itſelf.—Again, if we ſuppoſe the houſe with its conductor to ſtand on a part of the ground where the poſitively electrified zone is very thick, the conductor will neither ſilently draw off the electricity, nor will the lightning ſtrike it, though perhaps it may ſtrike a much lower object, or even the ſurface of the ground itſelf, at no great diſtance; the reaſon of which undoubtedly is, that there the zone of poſitively electrified earth is thinner than where the conductor was.

We muſt alſo obſerve, that the Franklinians make their pointed conductors to be of too great conſequence. To the houſes on which they are fixed, no doubt, their importance is very great: but in exhauſting a thunder-cloud of its electricity, their uſe muſt appear trifling; and to inſiſt on it, ridiculous. Innumerable objects, as trees, graſs, &c. are all conſpiring to draw off the electricity, as well as the conductor, if it could be drawn off; but of effecting this there is an impoſſibility, becauſe they have the ſame kind of electricity with the clouds themſelves. The conductor hath not even the power of *attracting* the lightning a few feet out of the direction which it would chooſe of itſelf. Of this we have a moſt remarkable and deciſive inſtance in what happened to the magazine at Purfleet in Eſſex, on May 15. 1777. That houſe was furniſhed with a pointed conductor, raiſed above the higheſt part of the building; nevertheleſs, about ſix in the evening of the abovementioned day, a flaſh of lightning ſtruck an iron cramp in the corner of the wall conſiderably lower than the top of the conductor, and only 46 feet in a ſloping line diſtant from the point.—This produced a long diſpute with Mr Wilſon concerning the propriety of uſing pointed conductors; and, by the favour of his majeſty, he was enabled to conſtruct a more magnificent electrical apparatus than any private perſon could be ſuppoſed to erect at his own expence, and of which ſome account is given under the article ELECTRICITY, n° 83. The only new experiments, however, which this apparatus produced, were the firing of gunpowder by the electric *aura*, as it is called; and a particularly violent ſhock which a perſon received when he held a ſmall pointed wire in his hand, upon which the conductor was diſcharged. We muſt obſerve, that the electrified ſurface of the conductor was 620 feet; and we can have but little idea of the ſtrength of ſparks from a conductor of this magnitude, ſuppoſing it properly electrified. Six turns of the wheel made the diſcharge felt through the whole body like the ſtrong ſhock of a Leyden vial; and nobody choſe to make the experiment when the conductor had received a higher charge. A very ſtrong ſhock was felt, as already obſerved, when this conductor was diſcharged upon a pointed wire held in a perſon's hand, even though the wire communicated with the earth; which was not felt, or but very little, when a knobbed wire was made uſe of. To account for this difference may, perhaps, puzzle electricians; but with regard to the uſe of blunt or pointed thunder-rods, both experiments ſeem quite inconcluſive. Though a very great quantity of electric matter ſilently drawn off will fire gunpowder, this only proves that a pointed conductor ought not to paſs through a barrel of gunpowder; and if a perſon holding a pointed wire in his hand received a ſtrong ſhock from Mr Wilſon's great conductor, it can thence only be inferred, that in the time of thunder nobody ought to hold the conductor in their hands; both which precautions common ſenſe would dictate without any experiment. From the accident at Purfleet, however, the diſputants on both ſides ought to have ſeen, that, with regard to lightning, neither points nor knobs can *attract*. Mr Wilſon ſurely had no reaſon to condemn the pointed conductor for *ſoliciting* the flaſh of lightning, ſeeing it did not ſtrike the point of the conductor, but a blunt cramp of iron; neither have the Franklinians any reaſon to boaſt of its effect in *ſilently drawing off* the electric matter, ſince all its powers were neither able to prevent the flaſh, nor to turn it 46 feet out of its way. The matter of fact is, the lightning was determined to enter the earth at the place where the board-houſe ſtands, or near it. The conductor fixed on the houſe offered the eaſieſt communication: but 46 feet of air intervening between the point of the conductor and the place of exploſion, the reſiſtance was leſs through the blunt cramp of iron, and a few bricks moiſtened with rain-water, to the ſide of the metalline conductor, than through the 46 feet of air to its point; for the former was the way in which the lightning actually paſſed.

Mr Wilſon and his followers ſeem alſo miſtaken in ſuppoſing that a pointed conductor can ſolicit a greater diſcharge than what would otherwiſe happen. Allowing the quantity of electricity in the atmoſphere during the time of a thunder-ſtorm to be as great as they pleaſe to ſuppoſe; nevertheleſs, it is impoſſible that the air can part with all its electricity at once, on account of the difficulty with which the fluid moves in it. A pointed conductor, therefore, if it does any thing at all, can only ſolicit the partial diſcharge

Lightning. which is to be made at any rate: and if none were to be made though the conductor was abſent, its preſence will not be able to effect any.

An objection to the uſe of conductors, whether blunt or pointed, may be drawn from the accident which happened to the poor-houſe at Heckingham, which was ſtruck by lightning though furniſhed with eight pointed conductors; but from an accurate conſideration of the manner in which the conductors were ſituated, it appears, that there was not a poſſibility of their preventing any ſtroke. See Philoſophical Tranſactions, Vol. LXXII. p. 361.

13 Lord Mahon's theory of lightning.

In a late publication on the ſubject of electricity by Lord Mahon, we find a new kind of lightning made mention of, which he is of opinion may give a fatal ſtroke, even though the main exploſion be at a conſiderable diſtance; a mile, for inſtance, or more. This he calls *the electrical returning ſtroke;* and exemplifies it in the following manner, from ſome experiments made with a very powerful electrical machine, the prime conductor of which (ſix feet long, by one foot diameter) would generally, when the weather was favourable, ſtrike into a braſs ball connected with the earth, to the diſtance of 18 inches or more. In the following account, this braſs ball, which we ſhall call *A*, is ſuppoſed to be conſtantly placed at the *ſtriking diſtance*; ſo that the prime conductor, the inſtant that it becomes fully charged, explodes into it.

Another large conductor, which we ſhall call the *ſecond conductor*, is ſuſpended, in a perfectly inſulated ſtate, farther from the prime conductor than the *ſtriking diſtance*, but within its *electrical atmoſphere;* at the diſtance of *ſix feet*, for inſtance. A perſon ſtanding on an inſulating ſtool touches this *ſecond conductor* very lightly with a finger of his right hand; while, with a finger of his left hand, he communicates with the earth, by touching very lightly a ſecond braſs ball fixed at the top of a metallic ſtand, on the floor, and which we ſhall call *B*.

While the prime conductor is receiving its electricity, ſparks paſs (at leaſt if the diſtance between the two conductors is not too great) from the ſecond conductor *to* the inſulated perſon's right hand; while ſimilar and ſimultaneous ſparks paſs out *from* the finger of his left hand into the ſecond metallic ball *B*, communicating with the earth. Theſe ſparks are part of the *natural quantity* of electric matter belonging to the ſecond conductor, and to the inſulated perſon; driven from them into the earth, through the ball *B*, and its ſtand, by the elaſtic preſſure or action of the electrical atmoſphere of the prime conductor. The ſecond conductor and the inſulated perſon are hereby reduced to a *negative* ſtate.

At length, however, the prime conductor, having acquired its *full charge*, ſuddenly ſtrikes into the ball *A*, of the firſt metallic ſtand, placed for that purpoſe at the *ſtriking diſtance* of 17 or 18 inches. The exploſion being made, and the prime conductor ſuddenly robbed of its electric atmoſphere, its preſſure or action on the ſecond conductor, and on the inſulated perſon, as ſuddenly ceaſes; and the latter inſtantly feels a ſmart *returning ſtroke*, though he has no direct or viſible communication (except by the floor) either with the *ſtriking* or *ſtruck* body, and is placed at the diſtance of *five* or *ſix feet* from both of them. This returning ſtroke is evidently occaſioned by the ſudden *re entrance* of the electric fire *naturally* belonging to his body and to the ſecond conductor, which had before been expelled from them by the action of the charged prime conductor upon them; and which returns to its former place the inſtant that action or elaſtic preſſure ceaſes. The author ſhows, that there can be no reaſon to ſuppoſe that the electrical diſcharge from the prime conductor ſhould in this experiment *divide itſelf* at the inſtant of the exploſion, and go different ways, ſo as to ſtrike the ſecond conductor and inſulated perſon in this manner, and at ſuch a diſtance from it. Lightning.

When the ſecond conductor and the inſulated perſon are placed in the *denſeſt* part of the electrical atmoſphere of the prime conductor, or *juſt beyond* the ſtriking diſtance, the effects are ſtill more conſiderable; the *returning ſtroke* being extremely ſevere and pungent, and appearing conſiderably ſharper than even the *main ſtroke* itſelf, received directly from the prime conductor. This circumſtance the author alleges as an unanſwerable proof that the effect which he calls the *returning ſtroke*, was not produced by the *main ſtroke* being any wiſe *divided* at the time of the exploſion, ſince no *effect* can ever be greater than the *cauſe* by which it is *immediately* produced.—Having taken the *returning ſtroke* eight or ten times one morning, he felt a conſiderable degree of pain acroſs his cheſt during the whole evening, and a diſagreeable ſenſation in his arms and wriſts all the next day.

We come now to the application of this experiment, and of the doctrine deduced from it, to what paſſes in *natural electricity*, or during a thunder-ſtorm; in which there is reaſon to expect ſimilar effects, but on a larger ſcale:—a ſcale ſo large indeed, according to the author's repreſentation, that perſons and animals may be deſtroyed, and particular parts of buildings may be conſiderably damaged, by an electrical *returning ſtroke*, occaſioned even by ſome *very diſtant exploſion* from a thunder-cloud:—poſſibly at the diſtance of a mile or more.

It is certainly eaſy to conceive, that a charged extenſive thunder-cloud muſt be productive of effects ſimilar to thoſe produced by the author's prime conductor. Like it, while it continues charged, it will, by *the ſuperinduced elaſtic electrical preſſure* of its atmoſphere, to uſe the author's own expreſſion, drive into the earth a part of the electric fluid *naturally* belonging to the bodies which are within the reach of its *widely extended* atmoſphere; and which will therefore become *negatively* electrical. This portion too of their electric fire, as in the artificial experiments, will, on the exploſion of the cloud, *at a diſtance*, and the ceſſation of its action upon them, ſuddenly *return* to them; ſo as to produce an equilibrium, and reſtore them to their *natural* ſtate.

14 Anſwered by the Reviewers.

To this theory, the authors of the Monthly Review have given the following anſwer: "We cannot, however, agree with the ingenious author, with reſpect to the *greatneſs* of the effects, or of the danger to be apprehended from the *returning ſtroke* in this caſe; as we think his eſtimate is grounded on an erroneous foundation.—'Since (ſays he) the denſity of the electrical atmoſphere of a *thunder-cloud* is ſo *immenſe*, when compared to the electrical denſity of the electrical atmoſphere of any *prime conductor*, charged by means of any electrical

Lightning. cal apparatus whatſoever; and ſince a *returning ſtroke*, when produced by the *ſudden* removal of even the *weak* elaſtic electrical preſſure of the electrical atmoſphere of a charged *prime conductor*, may be extremely *ſtrong*, as we have ſeen above; it is *mathematically evident*, that, when a *returning ſtroke* comes to be produced by the *ſudden* removal of the very ſtrong elaſtic electrical preſſure of the electrical atmoſphere of a thunder-cloud powerfully charged; the ſtrength of ſuch a *returning ſtroke* muſt be enormous.'

"If indeed the quantity of electric fluid *naturally* contained in the body of a man, for inſtance, were immenſe, or indefinite, the author's eſtimate between the effects producible by a cloud, and thoſe cauſed by a prime conductor, might be admitted. But ſurely an electrified cloud,—how great ſoever may be its extent, and the height of its charge when compared with the extent and charge of a prime conductor—cannot expel from a man's body (or any other body) *more* than the *natural* quantity of electricity which it contains. On the ſudden removal, therefore, of the preſſure by which this natural quantity had been expelled, in conſequence of the exploſion of the cloud into the earth; *no more* (at the utmoſt) than his *whole natural ſtock* of electricity can re-enter his body (c). But we have no reaſon to ſuppoſe that this quantity is ſo great, as that its ſudden re-entrance into his body ſhould deſtroy or even injure him.

"In the experiment above deſcribed, the inſulated perſon receives into his body, at the inſtant of the *returning ſtroke*, not only all that portion of his own natural electric fire which had been expelled from it; but likewiſe tranſmits through it, at the ſame inſtant, *in conſequence of his peculiar ſituation*, all the electric fire of which the large ſecond conductor had been robbed; and which muſt neceſſarily *re*-paſs through his body, to arrive at that conductor. To render the caſe ſomewhat parallel, in *natural electricity*, the man's body muſt be ſo peculiarly circumſtanced, ſuppoſing him to be in a houſe, that the electric matter which has been expelled from the houſe into the earth, by the preſſure of an extenſive thunder-cloud, could not return back into the building, on the exploſion of the cloud at a diſtance, without paſſing through his body: a caſe not likely to happen, unleſs the houſe were inſulated (like the ſecond conductor in the preceding experiment), and his body became the channel through which alone the houſe could have its electric matter reſtored to it; it appears much more probable that the electric matter returns to the houſe through the *ſame channels* by which it before inſenſibly paſſed out, and with equal ſilence, though more ſuddenly.

"In the caſe of a man who is abroad, and in an open field, during the time of an exploſion:—as he is unconnected with other maſſes of matter *above him*, no more than the preciſe quantity of electric fire, which had been before expelled from his body, will *ſuddenly* return into it at the inſtant of a diſtant exploſion: and that this quantity is not uſually very large, may be inferred from many conſiderations. Lightning.

"When a perſon ſtanding on the ground holds a pair of Mr Canton's balls in his hand, while a highly charged thunder-cloud is ſuſpended over his head; the angle made by the balls indicates the *electrical ſtate* of that perſon, or the quantity of *natural* electricity of which his body is at that time deprived, by the action of the (*poſitively*) charged cloud hanging over him. But we have never ſeen the repulſion of the balls ſo conſiderable, as to furniſh any juſt apprehenſions that the return of his natural electric matter, however ſudden, could be attended with injury to him: nor would he be ſenſible of any commotion on the balls ſuddenly coming together; though a ſpark might undoubtedly be perceived, at that inſtant, were he inſulated, and placed in the ſame manner with the author when he tried the above-related experiment.

"The author nevertheleſs obſerves, that 'there have been inſtances of perſons who have been killed by *natural* electricity, having been found with their *ſhoes torn*, and with their *feet* damaged by the electrical fire; but who have not had, over their whole body, any other apparent marks of having been ſtruck with lightning.' He adds, 'if a man walking out of doors were to be killed by a *returning ſtroke*, the electrical fire would ruſh into that man's body through his *feet*, and his feet only; which would *not* be the caſe, were he to be killed by any *main ſtroke* of exploſion, either poſitive or negative.'

"It would be no difficult taſk, we think, to account for theſe appearances in a different manner; were all the circumſtances attending the caſe minutely aſcertained: but without interrogating the *dead* on this ſubject, we may more ſatisfactorily appeal to the experience of the *living* (d), to ſhow, that though the *returning ſtroke* muſt take place, in all thunder-ſtorms, *in ſome degree or other*; yet it is not of that alarming magnitude which the author aſcribes to it. If, in any particular thunder-ſtorm, a man in the open fields could be killed, at the inſtant of a diſtant exploſion, merely by the *return* of his *own* electric fire, which had before been driven out of his body; ſurely numerous obſervations of perſons who had experienced the *returning ſtroke*, in *ſlighter* degrees, would be familiar; and ſcarce a great thunder-ſtorm muſt have occurred, in which one

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(c) "We ſuppoſe the perſon not to be ſo ſituated, that the *returning fire* of other bodies muſt neceſſarily paſs through his body."

(d) "The author does indeed produce a *living* evidence, in the caſe of a perſon at Vienna, who, he has been credibly informed, received an electrical ſhock, by having held one hand accidentally in contact with an *interrupted* metallic conducting rod, at the inſtant that a thunder-cloud exploded at the diſtance, as was conjectured, of above half an Engliſh mile. He likewiſe obſerves, that a 'very ſtrong, bright, and ſudden *ſtroke*' (or ſpark) of electrical fire has been ſeen, by ſeveral electricians, to paſs in the interval, or interruption, purpoſely left in the conducting rod of a houſe at the inſtant of a diſtant exploſion; and 'when it was fully proved, by the ſharp point of the conductor not being melted, or even tinged,' that the conductor itſelf had not been ſtruck.—Theſe obſervations, however, do not by any means prove the *magnitude* or *danger* of the returning ſtroke, but merely its *exiſtence*; which we do not conteſt."

Lightning. one perſon or another muſt not, at the inſtant of an exploſion, have felt the effects of the *returning ſtroke*, in *ſome degree or other*—from that of a violent *concuſſion*, to that of a ſlight and almoſt imperceptible *pulſation*. But no obſervations of this kind are known to us; nor have we ever heard of any perſon's experiencing any kind of electrical commotion in a thunder-ſtorm, except ſuch as have either been directly ſtruck, or have happened to be in the *very near neighbourhood* of the ſpot where the exploſion took place.

"The author has been aware of this objection, which he propoſes, and endeavours to remove: but his anſwer to it amounts to little more than what has been already quoted from him; that is, to a ſimple eſtimate of the enormous difference between the electrical denſity, or the *elaſtic electrical preſſure*, of the atmoſphere of an extenſive *thunder cloud*, and that of a charged *prime conductor*. We have already obſerved, that this is not the proper method of eſtimating their different effects, when theſe two cauſes, how unequal ſoever in power, are conſidered as exerting that power on bodies containing a *limited* and comparatively *ſmall*, quantity of electric matter.

"We have been induced to diſcuſs this ſubject thus particularly, with a view to quiet the minds of the timorous; as the author's extenſion of his principles, reſpecting the returning ſtroke in *artificial* electricity, to what paſſes in *natural* electricity, holds out a new, and, in our opinion, groundleſs ſubject of terror to thoſe who, in the midſt of their apprehenſions, have hitherto only dreaded the effects of a thunder-ſtorm when it made near approaches to them; but who, if this doctrine were believed, would never think themſelves in ſecurity while a thunder-cloud appeared in ſight, unleſs ſheltered in a houſe furniſhed with proper conductors:—for we ſhould not omit to remark, that a ſubſequent obſervation tends to diminiſh their fears, by ſhowing that *high* and *pointed* conductors tend to ſecure both perſons and buildings againſt the various effects of any *returning ſtroke* whatever, as well as of the *main ſtroke*."

15 Remarkable accident by an electrical exploſion from the earth.

A late melancholy accident which happened in Scotland has afforded Lord Mahon an opportunity of bringing additional arguments in favour of his ſyſtem. An account of this accident is given by Patrick Brydone, Eſq; F. R. S. in the 77th volume of the Philoſophical Tranſactions. It happened on the 19th of July 1785, near Coldſtſtream on the Tweed. The morning was fine, with the thermometer at 68°; but about eleven o'clock the ſky became obſcured with clouds in the ſouth-eaſt: and betwixt twelve and one a ſtorm of thunder and lightning came on. This ſtorm was at a conſiderable diſtance from Mr Brydone's houſe, the intervals between the flaſh and crack being from 25 to 30 ſeconds, ſo that the place of exploſion muſt have been betwixt five and ſix miles off: but while our author was obſerving the progreſs of the ſtorm, he was ſuddenly ſurpriſed with a loud report, neither preceded nor accompanied by any flaſh of lightning, which reſembled the exploſion of a great number of muſkets, in ſuch quick ſucceſſion, that the ear could ſcarcely diſcriminate the ſounds. On this the thunder and lightning inſtantly ceaſed, the clouds began to ſeparate, and the ſky ſoon recovered its ſerenity. In a little time Mr Brydone was informed, that a man with two horſes had been killed by the thunder; and, on running out to the place, our author found the two horſes lying on the ſpot where they had been firſt ſtruck, and ſtill yoked to the cart. As the body of the man who was killed had been carried off, Mr Brydone himſelf had not an opportunity of examining it, but was informed by Mr Bell, miniſter of Coldſtream, who ſaw it, that the ſkin of the right thigh was much burnt and ſhrivelled; that there were many marks of the ſame kind all over the body, but none on the legs: his clothes, particularly his ſhirt, had a ſtrong ſmell of burning; and there was a zigzag line of about an inch and a quarter broad, extending from the chin to the right thigh, and which ſeemed to have followed the direction of the buttons of his waiſtcoat. The body was buried in two days without any appearance of putrefaction. Lightning.

Mr Brydone was informed by another perſon who accompanied him that was killed, of the particular circumſtances. They were both driving carts loaded with coals; and James Lauder, the perſon who was killed, had the charge of the foremoſt cart, and was ſiting on the fore part of it. They had croſſed the Tweed a few minutes before at a deep ford, and had almoſt gained the higheſt part of an aſcent of about 65 or 70 feet above the bed of the river, when he was ſtunned with the report above mentioned, and ſaw his companion with the horſes and cart fall down. On running up to him, he found him quite dead, with his face livid, his clothes torn in pieces, and a great ſmell of burning about him. At the time of the exploſion he was but about 24 yards diſtant from Lauder's cart, and had him full in view when he fell, but felt no ſhock, neither did he perceive any flaſh or appearance of fire. At the time of the exploſion his horſes turned round, and broke their harneſs. The horſes had fallen on their left ſide, and their legs had made a deep impreſſion on the duſt; which, on lifting them up, ſhowed the exact form of each leg, ſo that every principle of life ſeemed to have been extinguiſhed at once, without the leaſt ſtruggle or convulſive motion. The hair was ſinged over the greateſt part of their bodies, but was moſt perceptible on their belly and legs. Their eyes were dull and opaque, as if they had been long dead, though Mr Brydone ſaw them in half an hour after the accident happened. The joints were all ſupple, and he could not obſerve that any of the bones were broken or diſſolved, as is ſaid to be ſometimes the caſe with thoſe who are killed by lightning. The left ſhaft of the cart was broken, and ſplinters had been thrown off in many places; particularly where the timber of the cart was connected by nails or cramps of iron. Many pieces of the coal were thrown to a conſiderable diſtance; and ſome of them had the appearance of being ſome time on a fire. Lauder's hat was torn into innumerable ſmall pieces; and ſome part of his hair was ſtrongly united to thoſe which had compoſed the crown of it. About four feet and a half behind each wheel of the cart he obſerved a circular hole of about 20 inches diameter, the centre of which was exactly in the track of each wheel. The earth was torn up as if by violent blows of a pick-ax; and the ſmall ſtones and duſt were ſcattered on each ſide of the road. The tracks of the wheels were ſtrongly marked in the duſt, both before and behind theſe holes, but did not in the ſmalleſt

Lightning. smalleſt degree appear on the ſpots themſelves for upwards of a foot and a half. There were evident marks of fuſion on the iron rings of the wheels; the ſurface of the iron, the whole breadth of the wheel, and for the length of about three inches, was become bluiſh, had loſt its poliſh and ſmoothneſs, and was formed into drops which projected ſenſibly, and had a roundiſh form; but the wood did not appear any way injured by the heat which the iron muſt have conceived. To determine whether theſe were made by the exploſion which had torn up the ground, the cart was puſhed back on the ſame tracts which it had deſcribed on the road; and the marks of fuſion were found exactly to correſpond with the centres of the holes. They had made almoſt half a revolution after the exploſion; which our author aſcribes to the cart being pulled a little forward by the fall of the horſes. Nothing remarkable was obſerved on the oppoſite part of the wheel. The broken ground had a ſmell ſomething like that of ether; the ſoil itſelf was very dry and gravelly.

The cataſtrophe was likewiſe obſerved by a ſhepherd, at the diſtance of about 200 or 300 yards from the ſpot. He ſaid, that he was looking at the two carts going up the bank when he heard the report, and ſaw the foremoſt man and horſes fall down; but obſerved no lightning, nor the leaſt appearance of fire, only he ſaw the duſt riſe about the place. There had been ſeveral flaſhes of lightning before that from the ſouth-eaſt; whereas the accident happened to the north-weſt of the place where he ſtood. He was not ſenſible of any ſhock.

Our author next gives an account of ſeveral phenomenena which happened the ſame day, and which were evidently connected with the exploſion. A ſhepherd tending his flock in the neighbourhood, obſerved a lamb drop down; and ſaid, that he felt at the ſame time as if fire had paſſed over his face, though the lightning and claps of thunder were at a conſiderable diſtance. He ran up to the creature immediately, but found it quite dead; on which he bled it with his knife, and the blood flowed freely. The earth was not torn up; nor did he obſerve any duſt riſe, though he was only a few yards diſtant. This happened about a quarter of an hour before Lauder was killed, and the place was only about 300 yards diſtant.

About an hour before the exploſion, two men ſtanding in the middle of the Tweed, fiſhing for ſalmon, were caught in a violent whirlwind, which felt ſultry and hot, and almoſt prevented them from breathing. They could not reach the bank without much difficulty and fatigue; but the whirlwind laſted only a very ſhort time, and was ſucceeded by a perfect calm.

A woman making hay, near the banks of the river, fell ſuddenly to the ground, and called out that ſhe had received a violent blow on the foot, and could not imagine from whence it came; and Mr Bell, the miniſter above mentioned, when walking in his garden, a little before the accident happened to Lauder, felt ſeveral times a tremor in the ground.

16 Mr Brydone's concluſions from the facts.

The concluſion drawn from theſe facts by Brydone is, that at the time of the exploſion the equilibrium between the earth and the atmoſphere ſeems to have been completely reſtored, as no more thunder was heard nor lightning obſerved; the clouds were diſpelled, and the atmoſphere reſumed the moſt perfect tranquillity: "But how this vaſt quantity of electric matter (ſays he) could be diſcharged from the one element to the other, without any appearance of fire, I ſhall not pretend to examine. From the whole it would appear, that the earth had acquired a great ſuperabundance of electrical matter, which was every where endeavouring to fly off into the atmoſphere. Perhaps it might be accounted for from the exceſſive dryneſs of the ground, and for many months the almoſt total want of rain, which is probably the agent that nature employs in preſerving the equilibrium between the two elements." Lightning.

17 Arguments drawn by Earl Stanhope in favour of his ſyſtem.

Lord Mahon, now Earl Stanhope, whoſe obſervations on this accident are publiſhed in the ſame volume, endeavours to eſtabliſh the following poſitions as facts.

1. That the man and horſes were not killed by any *direct main ſtroke of exploſion* from a thunder-cloud either poſitively or negatively electrified.

2. They were not killed by any *tranſmitted main ſtroke* either poſitive or negative.

3. The miſchief was not done by any *lateral exploſion*.

All theſe are evidently true, at leaſt with reſpect to lightning at that time falling from the clouds; for all the lightning which had taken place before was at a great diſtance.

4. They were not ſuffocated by a ſulphureous vapour or ſmell which frequently accompanies electricity. This could not account for the pieces of coal being thrown to a conſiderable diſtance all round the cart, and for the ſplinters of the wood which were thrown off from many parts of the cart.

5. It might be imagined by ſome that they were killed by the violent commotion of the atmoſphere, occaſioned by the vicinity of the electrical exploſion, in a manner ſimilar to the fatal wounds that ſometimes have been known to have been given by the air having been ſuddenly diſplaced by a cannon-ball in its paſſage through the atmoſpherical fluid, though the cannon-ball itſelf had evidently neither ſtruck the perſon wounded nor grazed his clothes. The duſt that roſe at the time of the exploſion might be brought as an argument in favour of the opinion, that a ſudden and violent commotion of the air did occaſion the effects produced. But ſuch an explanation would not account for the marks of fuſion on the iron of the wheels, nor for the hair of the horſes being ſinged, nor for the ſkin of Lauder's body having been burnt in ſeveral places.

6. From theſe different circumſtances his Lordſhip is of opinion, that the effects proceeded from electricity; and that *no electrical fire did paſs* immediately, either from the clouds into the cart, or from the cart into the clouds. From the circular holes in the ground, of about 20 inches diameter, the reſpective centres of which were exactly in the track of each wheel, and the correſponding marks of fuſion in the iron of the wheels, it is evident that the electrical fire did paſs from the earth to the cart, or from the cart to the earth, through that part of the iron of the wheels which was in contact with the ground. From the ſplinters which had been thrown off in many places, particularly where the timber was connected by nails or cramps of iron, and from various other effects mentioned in Mr Brydone's account, it is evident, that there muſt have been a great commotion in the electrical fluid in all, or at leaſt in different parts of the cart, and in the bodies of the man and horſes, although there were no lightning.

7. All theſe phenomena, his lordſhip argues, may be explained in a ſatisfactory manner from the doctrine

Lightning. already laid down concerning the returning ſtroke. Before entering upon the ſubject of the main exploſion, however, he takes notice of the other phenomena already mentioned in Mr Brydone's account.

With regard to the caſe of the lamb, his lordſhip is of opinion, that it belongs to the moſt ſimple claſs of returning ſtrokes, *viz.* that which happens at a place where there is neither thunder nor lightning near; and that it may be produced by the ſudden removal of the elaſtic electrical preſſure of the electrical atmoſphere of a *ſingle* main cloud, as well as of an aſſemblage of clouds. It appears (ſays he) by Mr Brydone's account, that the ſhepherd who ſaw the lamb fall, was near enough to it to feel, in a ſmall degree, the electrical returning ſtroke at the ſame time that the lamb dropped down. —The blow which the woman received on the foot was unqueſtionably the returning ſtroke. When a perſon walking, or ſtanding, out of doors, is knocked down or killed by the returning ſtroke, the electrical fire muſt ruſh in, or ruſh out, as the caſe may be, through that perſon's feet, and through them only; which would not be the caſe were the perſon to be killed by any main ſtroke of exploſion either poſitive or negative.

8. In order to account for the manner in which the man and horſes were killed, his lordſhip premiſes, that, according to Mr Brydone's account, the cloud muſt have been many miles in length; inaſmuch as juſt before the report, the lightning was at a conſiderable diſtance, *viz.* between five and ſix miles. The loud report reſembled the firing of ſeveral muſkets ſo cloſe together, that the ear could ſcarcely ſeparate the ſounds, and was followed by no rumbling noiſe like the other claps. This indicates, that the exploſion was not far diſtant, and likewiſe that it was not extremely near: for, if the exploſion had been very near, the ear could not at all have ſeparated the ſounds.

18 Hypotheſis by which he accounts for the phenomena.

9. Let us now ſuppoſe a cloud, eight, ten, or twelve miles in length to be extended over the earth, and let another cloud be ſituated betwixt that and the earth; let them alſo be ſuppoſed charged with the ſame kind of electricity, and both poſitive. Let us farther ſuppoſe the lower cloud to be near the earth, only a little beyond the ſtriking diſtance; and the man, cart, and horſes, to be ſituated under that part of the cloud which is next the earth, and to be exactly as deſcribed by Mr Brydone, *viz.* near the ſummit of an hill, and followed by another a little farther down; and let us ſuppoſe the two clouds to be near each other juſt over the place where the man and horſes are: Let the remote end of the cloud approach the earth, and diſcharge its electricity into it. In this caſe the following effects will take place.

10. When the upper cloud diſcharges its electricity into the earth from the remote end, the lower cloud will diſcharge its electricity into the nearer end of the upper cloud, which is ſuppoſed to be directly over the place of the cart and horſes, or nearly ſo. This accounts for the loud report of thunder that was unaccompanied by lightning. The report muſt be *loud* from its being near; but no *lightning* could be perceived, by reaſon of the thick cloud ſituated immediately between the ſpectator and the ſpace betwixt the two clouds where the lightning appears.

11. As the lower cloud gradually approached towards the earth, that part of the latter where the man and horſes were, muſt of courſe become ſuperinduced by the elaſtic electrical preſſure of the electrical atmoſphere of the thunder-cloud; which ſuperinduced elaſtic electrical preſſure muſt gradually have increaſed as the cloud came cloſer to the earth, and approached nearer to the limit of the ſtriking diſtance. Lightning.

12. Hence, if any conducting body (not having prominent or conducting points) were to be placed upon the ſurface of the earth, and there electrically inſulated; then ſuch conducting body, by the laws of electricity, muſt, at its upper extremity (namely the part neareſt to the poſitive cloud) become *negative*; at its lower extremity it muſt become *poſitive*; and, at a certain intermediate point, it will be neither *plus* nor *minus*. This inſulated conducting body, thus ſituated, will be in three oppoſite ſtates at the ſame time, that is to ſay, it will be, at the ſame time, poſitively electrified, negatively electrified, and not electrified at all.—For a demonſtration of this propoſition, his lordſhip refers to his Principles of Electricity; but it is a generally known and eſtabliſhed fact in electricity.

13. If this conducting body on the ſurface of the earth be not inſulated, or be but imperfectly inſulated, then the whole of ſuch body, from its being immerged in the electrical atmoſphere of the poſitive cloud, will become negative; becauſe part of the electricity of the conducting body will in this caſe paſs into the earth; and the conducting body will become the more negative as it becomes the more deeply immerged into the denſe part of the elaſtic electrical atmoſphere of the approaching thunder-cloud.

14. When the lower cloud comes ſuddenly to diſcharge with an exploſion its ſuperabundant electricity into the upper one, then the elaſtic electrical atmoſphere of the former will ceaſe to exiſt; conſequently the electrical fluid, which had been gradually expelled into the common ſtock from the conducting body on the ſurface of the earth, muſt, by the ſudden removal of the ſuperinduced elaſtic electrical preſſure of the electrical atmoſphere of the thunder-cloud, ſuddenly return from the earth into the ſaid conducting body, producing a violent commotion ſimilar to the pungent ſhock of a Leyden jar in its ſenſation and effects.

19 Supposed effects of the returning ſtroke.

15. This, which his lordſhip calls *the electrical returning ſtroke*, he ſuppoſes to have been what killed the man and horſes in the preſent caſe, they having become ſtrongly negative before the exploſion. The man, according to Mr Brydone's account, was ſitting when he received the ſtroke, and his legs were hanging over the fore part of the cart at the time of the exploſion. The returning ſtroke, therefore, could not enter his body through the legs; and this accounts for the ſkin of his legs not having been at all burnt or ſhrivelled, as the ſkin was on many other parts of his body; and it likewiſe ſhows the reaſon why the zigzag line, which was terminated by the chin, did not extend lower than the thigh.

16. Mr Brydone likewiſe informs us, that the hair of the horſes was much ſinged over the greateſt part of their bodies, but was moſt perceptible on the belly and legs. This is eaſily accounted for by the returning ſtroke; for the lower part of the bodies of theſe animals muſt of courſe have been more affected than any other part, as the electrical fire muſt have ruſhed ſuddenly into their bodies through their legs, which had made a deep impreſſion on the duſt.

17.

Lightning.

17. The various effects produced on the cart may be explained alſo from the returning ſtroke with equal facility. The ſplinters were thrown off by reaſon of the interruption of good conductors; the wood being a much leſs perfect conductor than the iron. It is alſo evident, that it was the electrical returning fire that produced the marks of fuſion on that part of the iron of the wheels which was in contact with the ground; inaſmuch as the whole electricity, at the inſtant of the explofion, did enter at theſe places.

18. No perſon in the leaſt verſed in the principles of electricity can heſitate to aſſent to the propoſition, that the electrical returning ſtroke muſt exiſt under circumſtances ſimilar to thoſe explained above; but it may be objected, as the reviewers formerly did, that the quantity of electricity naturally contained in the body of a man, &c. is by far too ſmall to produce ſuch violent effects. For an anſwer to this objection, his lordſhip refers to his book: By way of corroboration, however, he makes the following remarks.

20 Great ſtrength of the returning ſtroke in certain caſes.

19. No perſon can reaſonably conclude, that the force of a returning ſtroke muſt always be weak when produced by the diſturbed electrical fluid of a man's body, by reaſon that a man's body contains but a ſmall quantity of electricity: for it has never been proved that a man's body contains only a ſmall quantity of electrical fluid; neither is there the ſmalleſt reaſon to believe ſuch an hypotheſis, which appears, on many accounts, to be completely erroneous; and if that hypotheſis be erroneous, the objection to the ſtrength of an electrical returning ſtroke remains altogether unſupported by argument. "When a body is ſaid to be *plus* or *poſitive* (ſays his lordſhip), it ſimply means, that the body contains more than its natural ſhare of electricity, but does not ſay that it is completely ſaturated with it. In like manner, when a body is ſaid to be *minus* or *negative*, it only ſignifies, that the body contains *leſs* than its natural ſhare of electricity; but does not imply that ſuch body is *completely exhauſted* of the electricity which it contains in its natural ſtate. "Now (ſays he), the ſtrength of natural electricity is ſo immenſe, when compared with the very weak effects of our largeſt and beſt contrived electrical machines, that I conceive we cannot, by means of artificial electricity, expel, from a man's body, thouſandth, or perhaps the ten-thouſandth part of the electrical ſtuid which it contains when in its natural ſtate."

20. An hypotheſis which eaſily accounts for any natural phenomenon has a much better claim to our attention than an oppoſite one, which prevents it from being intelligibly explained. There is no reaſon to conclude that any electrical machine, of any given ſize, is capable of rendering a conducting body either *completely plus* or *completely minus*; but far otherwiſe. And it would have been as logical for any perſon ſome years ago (when electrical machines were not brought to their preſent ſtate) to have maintained, that thoſe very imperfect machines were capable of rendering a body *completely poſitive* or *completely negative*, as for us to pretend to do it at this day. We evidently have not, with our machines, even approached the limit of electrical ſtrength, particularly in reſpect to the returning ſtroke: for it is remarkable, that, by the laws of electricity, the ſtrength of the electrical *returning ſtroke*, near the limit of the ſtriking diſtance, does increaſe in a greater ratio than the ſtrength of the main ſtroke from the charged body producing the elaſtic electrical atmoſphere ſuperinduced. Thus, let us attempt to produce the returning ſtroke by means of a metallic conductor of about 20 or 21 inches in length and of about two inches in diameter; and by means of another metallic body of equal dimenſions placed parallel to the prime conductor, juſt out of the limit of the ſtriking diſtance; and let the prime conductor be charged by one of the common glaſs globes of leſs than nine inches in diameter; the returning ſtroke in this caſe will be ſo weak, that it can hardly be ſaid to exiſt: but if the experiment be made by means of a large cylinder, and by means of a metallic prime conductor of about three feet four inches long, by nearly four inches and an half diameter, and alſo by means of another metallic body of equal dimenſions with this prime conductor, then there will be no kind of compariſon betwixt the ſtrength of the returning ſtroke obtained out of the ſtriking diſtance, and the ſtrength of the main ſtroke received immediately from the prime conductor; the ſharpneſs and pungency of the returning ſtroke being ſo much ſuperior. The returning ſtroke in this caſe is like the ſudden diſcharge of a weakly electrified Leyden jar, provided due attention be paid to the rules for obtaining a ſtrong returning ſtroke.

Lightning.

21 Strength of the returning ſtroke in different circumſtances.

21. In the caſe of a returning ſtroke, the ſtrength depends, according to his lordſhip's hypotheſis, not ſo much on the *quantity* of the electric fluid, as on its *velocity*; whence alſo it depends leſs on the quantity of ſurface uſed than on the ſtrength of the electrical preſſure of the elaſtic electrical atmoſphere ſuperinduced upon the body ſtruck previous to the exploſion. But the electrical preſſure of the elaſtic electrical atmoſphere of the great thunder-cloud which produced the miſchief on the preſent occaſion, muſt have been immenſely greater than that of a metallic prime conductor; and it is not ſurpriſing that the effects ſhould be proportioned to the cauſes.

22 Why the returning ſtroke was not felt by the man who drove the ſecond cart.

22. His lordſhip next accounts for the returning ſtroke not being felt by the man who followed Lauder's cart. This, he thinks, may in ſome degree be accounted for by the latter having been higher up the bank; though it may better be done by ſuppoſing the cloud to have been pending nearer the earth over the ſpot where Lauder was killed, than over the place where his companion was; for, in order to receive a dangerous returning ſtroke, it is neceſſary that he ſhould be immerged, not merely in the cloud's atmoſphere, but in the denſe part of the cloud's electrical atmoſphere. It may alſo be accounted for by ſuppoſing that the ſecond cart were either better connected with the common ſtock, or better inſulated; for either of theſe circumſtances will weaken a returning ſtroke prodigiouſly. Now Mr Brydone mentions, that there had been an almoſt total want of rain for many months. He alſo ſays, that the ground, at the place where Lauder was killed, was remarkably dry, and of a gravelly ſoil. This ſtate of the ground was particularly adapted to the production of the electrical returning ſtroke, when produced upon the large ſcale of nature, where the elaſtic electrical preſſure is ſo powerful.

To theſe arguments adduced by his lordſhip for the exiſtence and ſtrength of the electrical returning ſtroke, we ſhall add an account of ſome experiments publiſhed

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in the Gentleman's Magazine for 1785. They were made with an insulated rod of iron of considerable length, rising some feet higher than a common conductor placed at the other end of the house. A set of bells were affixed to the former, which in a thunder storm, even when the thunder was four or five miles distant, were rung by the electricity of the atmosphere; but whenever a flash of lightning burst from the cloud, even though at the distance just mentioned, the *same flash*, according to our author, passed through the conductor also, and the bells ceased to ring sometimes for several seconds; then they began again, and continued to ring till they were stopped by another flash. This flash which passed thro' the conductor was undoubtedly what earl Stanhope calls *the returning stroke*; of which we must now give some explanation: And in considering the whole doctrine of that stroke, together with the particular explanation laid down by his lordship, the following observations naturally occur.

23 Experiments with an insulated conductor.

1. In the experiments made by his lordship to demonstrate the existence of the returning stroke, there is a deception, of which the reviewers take notice, *viz.* that the man touches a large prime conductor, which, by the operation of the machine, becomes negatively electrified as well as himself. Hence when the discharge is made, all the fire returning to that conductor must pass through his body as well as that of which his body itself is supposed to be deprived; and this, though no other cause intervened, must nearly double the strength of the shock. To make the experiment more fairly, it would be necessary to take away this second conductor, and let the man only touch the brass ball communicating with the earth.

24 Deceptions in Earl Stanhope's experiments.

2. In this experiment there is another deception, not taken notice of by the reviewers, *viz.* that any body immersed in a positive electrical atmosphere becomes negative. Hence the second conductor, by being applied to the air positively electrified by the machine, becomes almost as strongly negative as if another machine had been applied to it on purpose; and this negative electricity will be the stronger in proportion to the strength of electricity in the air surrounding it. Again, it is well known that a plate of air may be charged by means of two smooth pieces of metal held at a small distance from each other, one of them connected with an electrical machine, and the other with the earth. Now supposing, instead of the usual communication, that a man standing upon an insulating stool, held the lower metallic plate in one hand, and with the other hand touched the earth, or a conductor communicating with it, it is plain, that by touching the upper plate, the electricity acquired by the air between them would be discharged, and that the man would feel what earl Stanhope calls the *returning stroke*; but which in truth is the shock of a charged electric substance, and would therefore be proportionably pungent. Now, in his lordship's experiments, the two conductors answer exactly to the two metallic plates above mentioned; the air between them receives a charge, and is discharged by the explosion from the prime conductor, because this conductor forms one of the charging plates. It is true, that the round shape of the conductors renders them unfavourable for trying the experiment; and this is one reason why it requires a great power of electricity to make the returning stroke sensible. The thickness of the plate of air interposed betwixt the two conductors is another reason: but this makes no difference as to the principles; for his lordship's experiment is undoubtedly no other than that of the Leyden phial. Were his lordship to use two flat plates instead of round conductors, the deception would then be removed; and we may venture to determine *à priori*, that the returning stroke would then be not only very severe, but even *dangerous*, with a very powerful machine and large plates.

25 Returning stroke not different from that of a charged phial.

3. Though the second conductor were entirely removed, yet there would still be a deception in this experiment, for then the surface of the man's body would act in some measure as one of the metallic plates; so that still the experiment would be on the principles of the Leyden phial, though much weaker than before.

26 How the experiment should be properly made.

4. In order to make this experiment absolutely without deception, the man should stand upon the ground without touching any thing; and in that case we may venture to affirm, that he would feel no returning shock. His being insulated varies the nature of the experiment entirely, as will easily be understood from the following considerations.

27 Another explanation of the phenomena.

Under the article ELECTRICITY, we have shown, that *positive* electricity does not consist in an *accumulation*, nor *negative* electricity in a *deficiency*, of the fluid; but that all electric phenomena are to be accounted for from the mere *motion* of the fluid, and that this motion is always a circulation. We have shown, that in the working of a common machine, the electric fluid comes from the earth; that it is accumulated around the prime conductor; evaporates in the air; and is then silently absorbed by the earth, and reconducted to the machine. Hence, in the charging of a machine which works positively, the earth, and all bodies on its surface, for some way round, are in a negative state; because they are then absorbing the electrical fluid from the atmosphere. That part of the earth indeed directly under the feet of the machine, and perhaps some little way farther, is *positive;* because it is *giving out* electricity: but the negative portion will be much more extensive. When the conductor is discharged by a spark, then the circulation ceases in a great measure by the collision of the two opposite streams of electric matter. All bodies on the surface of the earth, then, as far as it was negatively electrified, must receive what his lordship calls the *returning stroke:* but the electricity being diffused among such a number, and over such a wide extent, it is no wonder that it should be insensible. If, however, we insulate a large conducting body, and then make another part of it communicate with the earth by means of a good conductor, we instantly put it in a situation fit for transmitting more than its share of the electricity of the atmosphere, and reducing it to the state of the insulated rubber of an electrical machine, through which the whole quantity of electricity must pass to the phial held towards it, in order to be charged negatively. In proportion to this quantity transmitted the shock must be, not because the conductor has lost a large share of its *natural* electricity, but because a large quantity is *artificially* made to pass through it. We may therefore safely venture to assert, that, in thunder storms, unless a body transmits *more*

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than its natural proportion of electric matter, no ſhock will be felt, much leſs can the perſon be killed.

28 Difficulties which occur in his Lordſhip's hypotheſis.

5. In his explanation of the accident which happened to Lauder, his lordſhip is reduced to the greateſt difficulty, and makes one of the moſt unphiloſophical ſhifts in the world; no leſs than that of arranging the *clouds of heaven*, not according to fact, but according to his own imagination. He ſuppoſes the exiſtance of two clouds, one below the other; and aſcribes to them various motions and ſituations, which we have already taken notice of: but who knows whether ſuch clouds ever exiſted? His Lordſhip does not pretend that any body ever ſaw them; and thus he runs into what is termed by logicians a *vicious circle*: he firſt aſſumes data, purpoſely made to accord with his hypotheſis, and then proves the hypotheſis from the data.

6. Granting the arrangement of the clouds, and every thing that his lordſhip deſires, the main requiſite is ſtill wanting, *viz.* a flaſh of lightning at a diſtance to produce the returning ſtroke. According to him, the diſtant flaſh and returning ſtroke muſt be ſimultaneous; but Mr Brydone mentions no ſuch thing: on the contrary, there had been no flaſh for ſome little time before; and the immenſe velocity of the electric fluid will not allow us to ſuppoſe that it would take up the uſual time betwixt thunder-claps in travelling five or ſix miles.

7. His lordſhip accounts for no lightning being ſeen at the time of the exploſion in a very arbitrary and unnatural manner, by ſuppoſing it to have proceeded from a diſcharge of the one imaginary cloud into the other; and that it was not *ſeen* on account of the thickneſs of the lower cloud. A much more natural ſuppoſition muſt be, that it happened below the cart-wheels, but was not ſeen on account of its being daylight, and the cloud of duſt which it raiſed. The ſucceſſion of noiſes, too, indicated a ſucceſſion of exploſions, the flaſhes of which would be leſs eaſily obſerved than a ſingle large one.

8. It ſeems altogether impoſſible, that the *return* of any quantity of *natural* electricity into a body ſhould ſhatter that body to pieces. In the preſent caſe, the fire entered by a ſmall part of the iron of the wheels, and this part was melted. His lordſhip does not heſitate to own, that the fuſion was a proof that the *whole* fire belonging to the cart, man, and horſes, or at leaſt to the cart and man, had entered by this part of the wheels, and conſequently *more* than naturally belonged to that ſmall part of iron. The ſame evidence, however, will hold good with regard to every other part. We grant that the fire entered the man's body by his right thigh: this might have therefore been burnt by receiving the fire belonging to the whole body; but it ought then to have quietly diffuſed itſelf through the other parts of his body, or at leaſt if any damage had been done, it ought to have been done only to the internal parts. Inſtead of this, a broad zig-zag line upon his body indicated a vaſt quantity of electric matter running along the ſurface without entering the body at all. In like manner, his hat being torn in pieces, indicated a violent exploſion of electric matter at his head, where there ought to have been little or no exploſion, as none could be wanted there except what the *hat* had parted with; and it is ridiculous to ſuppoſe that *hats* part with ſuch quantities of electricity as would tear them in pieces by its return. The ſhivering of the cart, the burning and throwing about of the coals, and all the other circumſtances of the caſe, alſo point out in the cleareſt manner, not a quantity of electric matter returning to ſupply any natural deficiency, but an enormous exploſion of that matter from the earth overwhelming and deſtroying whatever ſtood in its way. That *two* exploſions were made from the earth is very evident, becauſe there were two holes in it; and the very ſize of theſe holes indicates a much greater diſcharge of electricity than we can *reaſonably* ſuppoſe to have been loſt by the man, horſes, and cart.

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29 Phenomena of the inſulated thunder-rod accounted for.

We ſhall now conſider the experiment quoted from the correſpondent in the Gentleman's Magazine. Theſe, as well as the accident under conſideration, undoubtedly ſhow, that, during the time of a thunder-ſtorm, both atmoſphere and earth are affected for a very conſiderable way. With regard to the *quantity* of this electrical affection, however, though it muſt undoubtedly be exceſſive when taken all together, we can by no means agree that it is ſo taken partially. From an experiment related in the Magazine above quoted, it appears, that the electricity of a violent thunder-ſtorm extends ſometimes over a circle of 100 miles diameter "Electricity (ſays the author) ſeldom appeared without a ſhower; but I was ſurpriſed, on the 5th of June 1784, that the bells rang with thin and very high clouds, and without the leaſt appearance of rain, till the next poſt brought me an account of a violent thunder-ſtorm, and very deſtructive hail, at a village 50 miles diſtant." We cannot by any means ſuppoſe, that all this ſpace was electrified like a charged phial; otherwiſe, great as the exploſions of lightning are, they would ſtill be much greater. This is evident even in our electrical machines. A ſingle phial may be charged much higher than a battery, as appears by the electrometer; but the battery, though leſs charged, will have incomparably more power than a ſingle phial. His lordſhip appears to have deceived himſelf in this matter, by miſtaking the *extent* of the electrified ſurface for the *quantity* of charge in every part of it. The ſurface of the earth in a thunder-ſtorm is exactly ſimilar to that of a charged conductor. According to the extent of electrified ſurface, the ſpark will be great or ſmall; and juſt ſo it is with lightning, for ſome kinds of it are much more deſtructive than others. In all caſes, however, the *quantity* of electricity in a particular ſpot is very inconſiderable. Lightning ſtrikes bodies, not becauſe they are highly electrified, but becauſe they afford a communication betwixt the atmoſphere and ſome place below the ſurface of the earth. This ſtroke is the aggregate of the whole electricity contained in a circle of probably many miles in diameter; but the returning ſtroke, if bodies are in their natural ſtate, can only be in proportion to the *quantity* of electricity in each ſubſtance contained within that ſpace. It is in fact the lightning itſelf diffuſed through the earth which makes the returning ſtroke; and it is impoſſible that every ſubſtance within two or three miles of the exploſion can receive the whole flaſh, or another equal to it. It is only in caſes where the quantity of electricity diffuſed through a great ſpace, happens to diſcharge

30 Of the *quantity* of electricity in any given portion of the earth's ſurface.

Lightning. itſelf through a human body or other conducting ſubſtance of no great bulk, that the effects upon the latter can be any way conſiderable. This was undoubtedly the caſe with the thunder-rod mentioned by the correſpondent in the Magazine; for it received either from the atmoſphere or from the earth, at the time of every flaſh, the whole quantity of electricity which had been diffuſed for a conſiderable way round. Pointed bodies, we know, draw off electricity very powerfully; inſomuch that an highly charged jar may be deprived of almoſt all its power by merely preſenting a needle to it. We can be at no loſs therefore to underſtand why a pointed conductor ſhould draw off the electricity from a large portion of the ſurface of the earth, or from a conſiderable portion of atmoſphere.

We muſt now, however, inquire into the reaſon of theſe appearances of ſparks in places at ſuch diſtance from the exploſion of the lightning. To underſtand this, we muſt always keep in our eye that principle ſo fully explained under the article ELECTRICITY, viz. that there never is, nor can be, a real *deficiency* of the electric fluid in any ſubſtance or in any place. It is to be conſidered as an abſolute *plenum*, and of conſequence it can have no other motion than a circulatory one. At every diſcharge of lightning therefore from the clouds into the earth, or from one cloud into another, there muſt be a return of the ſame quantity to thoſe clouds which have made the diſcharge. In the vaſt extent of electrified ſurface, ſome part of theſe returns muſt undoubtedly be made at great diſtances from the place where the exploſion of lightning happens. As long as matters remain in their natural ſtate, the electric matter will return by innumerable paſſages in ſuch ſmall ſtreams, that no perceptible effect upon any ſingle ſubſtance can take place. But if a body be ſo ſituated, that a large portion of the electric matter muſt return through it from the earth, then ſuch body will undoubtedly be more affected by every flaſh than the reſt of the ſubſtances around it; and if the communication with the earth be interrupted, a flaſh of fire will be perceived betwixt the conducting ſubſtance and the earth at the time that a flaſh burſts out from the cloud. The ſtrength of ſuch a flaſh, however, muſt by no means be ſuppoſed equivalent to that of the *main* ſtroke of lightning, unleſs we could ſuppoſe the whole electrical power of the vaſt circle already mentioned to be diſcharged through the conductor.

31 Particular explanation of the accident.

But though this may explain the reaſon of the ſparks or flaſhes obſerved in the caſe of the thunder-rod juſt mentioned, we cannot from this principle account for the accident which befel the man and horſes. There was indeed at that time a very violent emiſſion of electricity from the earth, but no diſtant flaſh of lightning happened at the ſame moment with it, to expel the electricity from the earth. It appears therefore, that the electricity had in this caſe been accumulating in the earth itſelf, in a manner ſimilar to that which produces earthquakes; and which is fully explained under that article. The thunder-ſtorm was the natural means employed to ſupply that part of the earth with electricity, which was in the ſtate of charging; and the moment that the quantity thus ſupplied was thrown back, all ſigns of electricity muſt ceaſe, as much as when that thrown in upon one ſide of a Leyden phial is again thrown off. Hence, when the flaſh burſt out of the earth, and killed the man and horſes, that portion of earth which abſorbed the electricity till then, required it no longer; and of conſequence the thunder-ſtorm occaſioned by this abſorption naturally ceaſed. Lightning.

That this diſpoſition to an earthquake did really prevail in the earth at that time, is evident from the *tremor* which Mr Bell felt on the ground when walking in his garden. The ſtroke which the woman received on the foot, the death of the lamb, and no doubt many ſimilar circumſtances, concurred to ſhow that there was an attempt to reſtore the equilibrium from the earth, as has been already related. The ſame diſpoſition to an earthquake, however, was afterwards renewed; and on the 11th of Auguſt that ſame year, a ſmart ſhock of an earthquake did actually take place, as Mr Brydone informs us in the ſame paper.

Beſides the different kinds of lightning already treated of, it is by no means uncommon to ſee flaſhes unattended by any report. Theſe are always of the ſheet kind; they happen very frequently in windy weather when the ſky is clear; and likewiſe when the ſky is cloudy, immediately before a fall of rain or ſnow. The general reaſon of theſe appears to be, that the electric fluid is the medium by which the vapours are ſuſpended in the atmoſphere; and of conſequence, every ſeparation of vapour, whether as rain, ſnow, or hail, muſt be attended with what is called a *diſcharge* of electrical matter. The reaſon why this kind of lightning is never attended with any report is, that there is no particular object againſt which the force of the flaſh is directed; but it diſſipates itſelf among the innumerable conducting bodies with which the atmoſphere always abounds. It is, however, in a manner impoſſible to explain the various ways in which this ſubtile fluid acts. We know not, for inſtance, in what ſtate it is when acting as a medium of connection betwixt the air and vapour, nor in what its *diſcharge* into other parts of the atmoſphere properly conſiſts. At any rate, we ſee that a flaſh of lightning, however limited its extent may appear to us, diffuſes its effects over a great ſpace of atmoſphere; for after one of theſe ſilent flaſhes, it is no uncommon thing to obſerve the ſky to become obſcure though it had been quite ſerene before; or, if it had been cloudy, to ſee rain or ſnow begin to fall in a very few minutes. It is probable indeed, that there is no change whatever that can take place in the atmoſphere but by means of electricity; and there is great reaſon to believe, that the ſilent diſcharges of this fluid from one part of the atmoſphere to another, many of which are totally inviſible, ultimately occaſion the whole of the phenomena of METEOROLOGY. See that article.

32 Directions for conducting rods.

Various parts of his Lordſhip's Treatiſe on Electricity, beſides thoſe already quoted, tend to prove the utility of *high* and *pointed* conductors, in preference to thoſe which terminate in a *ball*, or *rounded end*. Towards the end of the performance, the author diſcuſſes this matter very particularly; and enumerates the '*neceſſary requiſites*' in erecting them, in number 11; to every one of which we readily

Lightning. subſcribe. As this matter is of a popular nature, and on a ſubject generally intereſting, we ſhall tranſcribe this liſt; adding a ſhort explanation to particular articles.—Theſe requiſites (ſays the author) are 11 in number.

'1ſt, That the rod be made of ſuch ſubſtances as are, in their nature, the *beſt conductors of electricity*.

'2dly, That the rod be *uninterrupted*, and *perfectly continuous*.'—This is a very material circumſtance. One entire piece of metal cannot perhaps be had: but it is not ſufficient that the rods, of which the conductor conſiſts, be *ſenſibly* in contact; they ſhould be preſſed into *actual* contact by means of nuts and ſcrews, with a thin piece of ſheet-lead between the ſhoulders of the joints.

'3dly, That it be of a *ſufficient thickneſs*.'—A *copper* rod half an inch ſquare, or an *iron* rod one inch ſquare, or one of *lead* two inches ſquare, are thought fully ſufficient by the author.

'4thly, That it be perfectly connected with the common ſtock.'—That is, it ſhould be carried deep into the earth, which is frequently dry near the ſurface; and then continued in a horizontal direction, ſo as to have the farther extremity dipped, ſhould this be practicable, into water, at the diſtance of 10 yards or more from the foundation.

'5thly, That the upper extremity of the rod be as *acutely pointed* as poſſible.'—This termination ſhould be of copper; or rather a very fine and exceedingly acute needle of *gold* ſhould be employed, which will not materially add to the expence.

'6thly, That it be very finely tapered:'—ſo that the upper extremity may be a cone, the diameter of the baſe of which may bear an extremely ſmall proportion to its height; for inſtance, that of *one* to *forty*.

'7thly, That it be extremely prominent;'—that is, 8, 10, or 15 feet at leaſt above the higheſt parts of the building. The author lays great ſtreſs on this circumſtance; in conſequence of the law above-mentioned, deduced by him from his experiments, relating to electric atmoſpheres. According to this law, the denſity of an electric atmoſphere (the *negative* atmoſphere, for inſtance, of the roof of a houſe, &c. while a *poſitively* charged cloud hangs over it) diminiſhes in the inverſe ratio of the *ſquare* of the diſtance from the ſurface of the body to which that atmoſphere belongs. Accordingly, if the rod project 12 feet into this atmoſphere, it will reach to a part of it *four* times leſs denſe than if the rod projected only to *half* that diſtance, or ſix feet;—and to a part *one hundred and forty four* times rarer, than if it projected only *one* foot.

'8thly, That each rod be carried, in the ſhorteſt convenient direction, from the point at its upper end, to the common ſtock.

'9thly, That there be neither large nor prominent bodies of metal upon the top of the building propoſed to be ſecured, but ſuch as are connected with the conductor, by ſome proper metallic communication.

'10thly, That there be a *ſufficient number* of high and pointed rods.'—On edifices of great importance, eſpecially magazines of gun-powder, the author thinks theſe ought never to be above 40 or 50 feet aſunder.

'11thly, That every part of the rods be very ſubſtantially erected.'

The author declares that he has 'never been able Lightning. to hear of a *ſingle* inſtance, nor does he believe that any one can be produced, of an *high*, *tapering*, and *acutely pointed* metallic conductor, having ever, in any country, been ſtruck by lightning; if it had *all* the neceſſary requiſites abovementioned, eſpecially the ſecond and fourth.'

33 Uſe of conductors. On the whole, it ſeems to be pretty certain, that both pointed and knobbed metalline conductors have the power of preſerving any body placed at a ſmall diſtance from them from being ſtruck by lightning. This they do, not becauſe they can *attract* the lightning far out of its way, but becauſe the reſiſtance to its paſſage is always leaſt on that ſide where they are; and as pointed conductors diminiſh the reſiſtance more conſiderably than blunt ones, they ſeem in all caſes to be preferable.—It appears, however, that a ſingle conductor, whether blunt or pointed, is not capable of ſecuring all the parts of a large building from ſtrokes of lightning; and therefore ſeveral of them will be required for this purpoſe: but to what diſtance their influence extends, hath not been determined, nor does it ſeem eaſily capable of being aſcertained.

34 Why lightning ſometimes kills alternately. It now remains only to explain ſome of the more uncommon appearances and effects of lightning. One of theſe is, that it is frequently obſerved to kill alternately: that is, ſuppoſing a number of people ſtanding in a line; if the firſt perſon was killed, the ſecond perhaps would be ſafe; the third would be killed, and the fourth ſafe; the fifth killed, &c.—Effects of this kind are generally produced by the moſt violently kind of lightning; namely, that which appears in the form of balls, and which are frequently ſeen to divide themſelves into ſeveral parts before they ſtrike. If one of theſe parts of a fire-ball ſtrike a man, another will not ſtrike the perſon who ſtands immediately cloſe to him; becauſe there is always a repulſion between bodies electrified the ſame way. Now, as theſe parts into which the ball breaks have all the ſame kind of electricity, it is evident that they muſt for that reaſon repel one another; and this repulſion is ſo ſtrong, that a man may be interpoſed within the ſtroke of two of them, without being hurt by either.

35 Why it ſometimes marks bodies with the form of a croſs. The other effect of lightning is mentioned under the article JERUSALEM, where thoſe who attempted to rebuild the temple had the marks of croſſes impreſſed upon their garments and bodies. This may reaſonably be thought to ariſe from the ſame cauſe to which the angular appearance of lightning in the air is owing, namely, its violent impetus and velocity, together with the oppoſition of the atmoſphere. A ſmall ſtroke of lightning, ſometimes indeed a very conſiderable one, cannot always enter the ſubſtance of terreſtrial bodies, even when it touches them, for reaſons already given. In this caſe it runs along their ſurface, and, as in its motion it is perpetually reſiſted by the atmoſphere, it undoubtedly has the ſame angular motion which we often perceive in the atmoſphere. If in this ſituation it happens to touch the human ſkin, or a garment, eſpecially of linen, as being a conductor, it will undoubtedly leave a mark upon it; and this mark being of a zig-zag form, might, in the above inſtance, have been either taken for the exact form of a croſs.

Lightning ‖ Lignum.

croſs by the beholders, or have ſuggeſted that idea in relating the ſtory to make it appear more wonderful.

Theſe obſervations may ſerve to give ſome idea of the nature of lightning, and its operations after it appears in its proper form and burſts out from the cloud; but for an account of its original formation, and of the powers by which the clouds are at firſt electrified, and their electricity kept up notwithſtanding many ſucceſſive diſcharges of lightning, and the quantity of electric matter continually carried off by the rain, &c. ſee the article THUNDER.

Artificial LIGHTNING. Before the diſcoveries of Dr Franklin concerning the identity of electricity and lightning, many contrivances were invented in order to repreſent this terrifying phenomenon in miniature: the coruſcations of phoſphorus in warm weather, the accenſion of the vapour of ſpirit of wine evaporated in a cloſe place, &c. were uſed in order to ſupport the hypotheſis which at that time prevailed; namely, that lightning was formed of ſome ſulphureous, nitrous, or other combuſtible vapours, floating in long trains in the atmoſphere, which by ſome unaccountable means took fire, and produced all the deſtructive effects of that phenomenon. Theſe repreſentations, however, are now no more exhibited; and the only true artificial lightning is univerſally acknowledged to be the diſcharge of electric matter from bodies in which it is artificially ſet in motion by our machines.

LIGHTNING was looked upon as ſacred both by the Greeks and Romans, and was ſuppoſed to be ſent to execute vengeance on the earth: Hence perſons killed with lightning, being thought hateful to the gods, were buried apart by themſelves, leſt the aſhes of other men ſhould receive pollution from them. Some ſay they were interred upon the very ſpot where they died; others will have it that they had no interment, but were ſuffered to rot where they fell, becauſe it was unlawful for any man to approach the place. For this reaſon the ground was hedged in, leſt any perſon unawares ſhould contract pollution from it. All places ſtruck with lightning were carefully avoided and fenced round, out of an opinion that Jupiter had either taken offence at them, and fixed upon them the marks of his diſpleaſure, or that he had, by this means, pitched upon them as ſacred to himſelf. The ground thus fenced about was called by the Romans *bidentul*. Lightning was much obſerved in augury, and was a good or bad omen, according to the circumſtances attending it.

LIGNICENCIS TERRA, in the materia medica, the name of a fine yellow bole dug in many parts of Germany, particularly about Emeric in the circle of Weſtphalia, and uſed in cordial and aſtringent complaints.

LIGNUM VITÆ. See GUAIACUM.

Lignum Aloes. See EXCOECARIA.

Lignum Nephriticum. See GUILANDINA.

Lignum Rhodium, or *Roſewood*, in the materia medica; a wood, or root, chiefly brought to us from the Canary iſlands. The writers on botany and the materia medica are much divided about the lignum rhodium, not only with regard to the plant which affords it, but likewiſe in their accounts of the drug itſelf, and have deſcribed, under this name, ſimples manifeſtly different. This confuſion ſeems to have ariſen from an opinion, that the *rhodium*, and the *aſpalathus* (an article of conſiderable eſteem among the ancients, but with regard to which the moderns are very much at a loſs), are the ſame; whence different woods brought into Europe for the unknown aſpalathus, were ſold again by the name of *rhodium*.

Lignum ‖ Liguria.

In thoſe modern pharmacopœias which admit the lignum rhodium, different Linnæan names are at preſent given to it: thus the authors of the Diſpenſatorium Brunſvicenſe ſuppoſe it to be the *Rhodiola roſa* of Linnæus; and thoſe of the Pharmacopœia Roſſica, the *Geniſta Canarienſis*. As to *Aſpalathus*, the ancients themſelves diſagree; Dioſcorides meaning by this appellation the wood of a certain ſhrub freed from the bark, and Galen the bark of a root. At preſent we have nothing under this name in the ſhops. What was heretofore ſold among us as aſpalathus, were pieces of a pale-coloured wood brought from the Eaſt Indies, and more commonly called *calambour*.

The aſpalathus, calambour, and lignum aquilæ, are ſuppoſed to be woods of the nature of agallochum, or lignum aloes, but weaker in quality. The lignum rhodium of the ſhops is uſually in long crooked pieces, full of knots, which when cut appear of a yellow colour like box, with a reddiſh caſt: the largeſt, ſmootheſt, moſt compact, and deepeſt coloured pieces, ſhould be choſen; and the ſmall, thin, or pale ones, rejected. The taſte of this wood is lightly bitteriſh, and ſomewhat pungent; its ſmell is very fragrant, reſembling that of roſes: long kept, it ſeems to loſe its ſmell; but on cutting, or rubbing one piece againſt the other, it ſmells as well as at firſt. Diſtilled with water, it yields an odoriferous eſſential oil, in very ſmall quantity. Rhodium is at preſent in eſteem only upon account of its oil, which is employed as an high and agreeable perfume in ſcenting pomatums and the like. But if we may reaſon from analogy, this odoriferous ſimple might be advantageouſly applied to more uſeful purpoſes; a tincture of it in rectified ſpirit of wine, which contains in ſmall volume the virtue of a conſiderable deal of the wood, bids fair to prove a ſerviceable cordial, not inferior perhaps to any thing of this kind.

Lignum Campechenſe. See HEMATOXILUM.

Lignum Colubrinum. See OPHIORHIZA.

LIGULATED, among botaniſts, an appellation, given to ſuch floſcules as have a ſtraight end turned downwards, with three indentures, but not ſeparated into ſegments.

LIGURIA (anc. geog.), a country of Italy, bounded on the ſouth by the Mediterranean ſea, on the north by the Appennine mountains, on the weſt by part of Tranſalpine Gaul, and on the eaſt by Etruria. There is a great diſagreement among authors concerning the origin of the Ligurians, though moſt probably they were deſcended from the Gauls. Some carry up their origin as far as the fabulous heroes of antiquity; while others trace them from the Ligyes, a people mentioned by Herodotus as attending Xerxes in his expeditions againſt Greece. Theſe Ligyes are by ſome ancient geographers placed in Colchis; by others, in Albania.—According to Diodorus Siculus, the Ligurians led a very wretched life; their country being

Liguſticum, Liguſtrum.

being entirely overgrown with woods, which they were obliged to pull up by the root, in order to cultivate their land, which was alſo encumbered with great ſtones, and, being naturally barren, made but very poor returns for all their labour. They were much addicted to hunting; and, by a life of continual exerciſe and labour, became ſo ſtrong, that the weakeſt Ligurian was generally an overmatch for the ſtrongeſt and moſt robuſt among the Gauls. The women are ſaid to have been almoſt as ſtrong as the men, and to have borne an equal ſhare in all laborious enterpriſes. With all their bravery, however, they were not able to reſiſt the Roman power; but were ſubdued by that warlike nation, about 211 B. C.

LIGUSTICUM, LOVAGE, in botany: A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The fruit is oblong, and quinqueſulcated on each ſide; the florets are equal; the petals involuted or rolled inwards, and entire. There are ſeven ſpecies; of which the moſt remarkable are, the leviſticum or common, and the ſcoticum or Scots, lovage. The firſt is a native of the Apennine mountains in Italy. It has a thick fleſhy, deeply-penetrating perennial root, crowned by very large, many-parted, radical leaves, with broad lobes, having inciſions at top, upright, ſtrong, channelled ſtalks, branching ſix or ſeven feet high, and all the branches terminated by yellow flowers in large umbels. The ſecond is a native of Scotland, and grows near the ſea in various parts of the country. It has a thickiſh, fleſhy, penetrating, perennial root, crowned by large doubly-trifoliated leaves, with broad, ſhort, indented lobes, upright round ſtalks, half a yard high, terminated by ſmall yellow umbels. Both ſpecies are hardy, and eaſily propagated by ſeeds ſown in ſpring or autumn.

Medicinal uſes, &c. The root of the firſt ſpecies agrees nearly in quality with that of angelica: the principal difference is, that the lovage root has a ſtronger ſmell, and a ſomewhat leſs pungent taſte, accompanied with a more durable ſweetneſs, the ſeeds being rather warmer than the root; but although certainly capable of being applied to uſeful purpoſes, this root is not regarded in the preſent practice. The leaves of the ſecond are ſometimes eaten raw as a ſalad, or boiled as greens, by the inhabitants of the Hebrides. The root is reckoned a good carminative. They give an infuſion of the leaves in whey to their calves to purge them.

LIGUSTRUM, PRIVET, in botany: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 44th order, *Sepiariæ*. The corolla is quadrifid; the berry tetraſpermous. There is but one ſpecies; of which there are two varieties, the deciduous and the evergreen. They are hardy plants, riſing from 10 to 15 feet high, adorned with oblong entire leaves, and ſpikes of infundibuliform oblong white flowers, ſucceeded by black-berries. They are eaſily propagated by ſeed, layers, ſuckers, or cuttings. They are uſed for making hedges. Tke purple colour upon cards is prepared from the berries. With the addition of alum, theſe berries are ſaid to dye wool and ſilk of a good and durable green; for which purpoſe they muſt be gathered as ſoon as they are ripe. The leaves are bitter and ſlightly aſtringent. Oxen, goats, and ſheep, eat the plant; horſes refuſe it.

Liburne, Lilium.

LILBURNE (John), an enthuſiaſtic demagogue, who was tyrannically puniſhed by the ſtar-chamber court, being put in the pillory, whipped, fined, and impriſoned, for importing and publiſhing ſeditious pamphlets, which he had got printed in Holland; they chiefly reflected on the church of England and its biſhops: he ſuffered in 1637, and in priſon was doubly loaded with irons. In 1641, he was releaſed by the long parliament: and from this time, he had the addreſs to make himſelf formidable to all parties, by his bold, aſpiring genius. He ſignalized himſelf in the parliament army; and was at one time the ſecret friend and confident of Cromwell, and at another his avowed enemy and accuſer; ſo that, in 1650, Cromwell found it to be his intereſt to ſilence him, by a grant of ſome forfeited eſtates. But after this, he grew outrageous againſt the protector's government; became chief of the levellers; and was twice tried for high treaſon, but acquitted by the juries. The laſt was for returning from exile (having been baniſhed by the parliament) without a paſs. He died in 1657, aged 88.

LILIACEOUS, in botany, an appellation given to ſuch flowers as reſemble thoſe of the lily.

LILIUM, the LILY, in botany: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 10th order, *Coronariæ*. The corolla is hexapetalous, and campanulated, with a longitudinal nectariferous line or furrow; the capſules connected by ſmall cancellated hairs. There are many ſpecies; all of them bulbous-rooted, herbaceous, flowery perennials, riſing with erect annual ſtalks three or four feet high, garniſhed with long narrow leaves, and terminated by fine cluſters of large, bell-ſhaped, hexapetalous flowers of exceeding great beauty, of white, red, ſcarlet, orange, purple, and yellow colours.

Culture. All the ſpecies are propagated by ſowing the ſeeds; and if care is taken to preſerve theſe ſeeds from good flowers, very beautiful varieties are often produced. The manner of ſowing them is as follows. Some ſquare boxes ſhould be procured, about ſix inches deep, with holes bored in the bottoms to let out the wet: theſe muſt be filled with freſh, light, ſandy earth; and the ſeeds ſown upon them pretty thick in the beginning of Auguſt, and covered over about half an inch deep with light ſifted earth of the ſame kind. They ſhould then be placed where they may have the morning ſun; and if the weather proves dry, they muſt be watered at times, and the weeds carefully picked out. In the month of October the boxes are to be removed to a place where they may have as much ſun as poſſible, and be ſecured from the north and north-eaſt winds. In ſpring the young plants will appear, and the boxes are then to be removed into their former ſituation. In Auguſt the ſmalleſt roots are to be emptied out of theſe boxes, and ſtrewed over a bed of light earth, and covered with about half an inch depth of earth of the ſame kind ſifted over them. Here they muſt be watered, and ſhaded at times, and defended from the ſeverity of winter by a ſlight covering of ſtraw or peaſe-haulm in the hardeſt weather. In

Lilium, Lillo.

February, the ſurface of the bed ſhould be cleared, and a little light earth ſifted over it. When the leaves are decayed, the earth ſhould be a little ſtirred over the roots; and in the month of September following ſome more earth ſifted on. In the September of the following year, the roots muſt be tranſplanted to the places where they are to remain, and ſet at the diſtance of eight inches; the roots being placed four inches below the ſurface: this ſhould be done in moiſt weather. They will now require the ſame care as in the preceding winters; and, the ſecond year after they are tranſplanted, the ſtrongeſt roots will begin to flower. The fine ones ſhould then be removed at the proper ſeaſon into flower beds, and planted at great diſtances from one another that they may flower ſtrong.

Medical uſes. The roots of the white lily are emollient, maturating, and greatly ſuppurative. They are uſed externally in cataplaſms for theſe purpoſes with ſucceſs. The common form of applying them is boiled and bruiſed; but ſome prefer the roaſting them till tender, and then beating them to a paſte with oil, in which form they are ſaid to be excellent againſt burns. Gerard recommends them internally againſt dropſies.

The Kamtſchatence, or Kamtſchatka lily, called there *ſaranne*, makes a principal part of the food of the Kamtſchatkans. Its roots are gathered by the women in Auguſt, dried in the ſun, and laid up for uſe: they are the beſt bread of the country; and after being baked are reduced to powder, and ſerve inſtead of flour in ſoups and ſeveral diſhes. They are ſometimes waſhed, and eaten as potatoes; are extremely nouriſhing, and have a pleaſant bitter taſte. Our navigators boiled and eat them with their meat. The natives often parboil, and beat it up with ſeveral ſorts of berries, ſo as to form of it a very agreeable confection. Providentially it is an univerſal plant there, and all the grounds bloom with its flower during the ſeaſon. Another happineſs remarked there is, that while fiſh are ſcarce the ſaranne is plentiful; and when there is a dearth of this, the rivers pour in their proviſions in redoubled profuſion. It is not to the labours of the females alone that the Kamtſchatkans are indebted for theſe roots. A ſpecies of mouſe ſaves them a great deal of trouble. The ſaranne forms part of the winter proviſions of that little animal: they not only gather them in the proper ſeaſon, and lay them up in their magazines, but at times have the inſtinct of bringing them out in ſunny weather to dry them, leſt they ſhould decay. The natives ſearch for their hoards; but with prudent tenderneſs leave part for the owners, being unwilling to ſuffer ſuch uſeful caterers to periſh.

LILLO (George), an excellent dramatic writer, born at London in 1693. He was a jeweller by profeſſion, and followed his buſineſs for many years in that neighbourhood with the faireſt reputation. He was at the ſame time ſtrongly attached to the muſes, yet ſeemed to have laid it down as a maxim, that the devotion paid to them ought always to tend to the promotion of virtue, morality, and religion. In purſuance of this aim, Lillo was happy in the choice of his ſubjects, and ſhowed great power of affecting the heart, by working up the paſſions to ſuch a height, as to render the diſtreſſes of common and domeſtic life equally intereſting to the audiences as that of kings and heroes, and the ruin brought on private families by an indulgence of avarice, luſt, &c. as the havock made in ſtates and empires by ambition, cruelty, or tyranny. His "George Barnwell," "Fatal Curioſity," and "Arden of Feverſham," are all planned on common and well-known ſtories; yet they have perhaps more frequently drawn tears from an audience than the more pompous tragedies of Alexander the Great, All for Love, &c. In the prologue to "Elmeric," which was not acted till after the author's death, it is ſaid, that when he wrote that play, he "was depreſſed by want," and afflicted by diſeaſe; but in the former particular there appears to be evidently a miſtake, as he died poſſeſſed of an eſtate of L. 60 a-year, beſides other effects to a conſiderable value. His death happened in 1739, in the 47th year of his age. His works have been lately collected, and publiſhed, with an account of his life, in 2 vols 12mo, by Mr T. Davis.

Lilly

LILLY (John), a dramatic poet, was born in the wilds of Kent, about the year 1553, and educated in Magdalen-college, Oxford, where he took the degree of bachelor of arts in 1573, and that of maſter in 1575. From Oxford he removed to Cambridge; but how long he continued there, is uncertain. On his arrival in London, he became acquainted with ſome of Queen Elizabeth's courtiers, by whom he was careſſed, and admired as a poet and a wit; and her majeſty, on particular feſtivals, honoured his dramatic pieces with her preſence. His plays are nine in number. His firſt publication, however, printed in 1580, was a romance called *Euphues*, which was univerſally read and admired. This romance, which Blount, the editor of ſix of his plays, ſays introduced a new language, eſpecially among the ladies, is, according to Berkenhout, in fact a moſt contemptible piece of affectation and nonſenſe: nevertheleſs it ſeems very certain, that it was in high eſtimation by the women of faſhion of thoſe times, who, we are told by Whalley the editor of Ben Johnſon's works, had all the phraſes by heart; and thoſe who did not ſpeak *Euphuiſm* were as little regarded at court as if they could not ſpeak French. "He was (ſays Oldys) a man of great reading, good memory, ready faculty of application, and uncommon eloquence; but he ran into a vaſt exceſs of alluſion." When or where he died is not known. Anthony Wood ſays he was living in 1597, when his laſt comedy was publiſhed. After attending the court of Queen Elizabeth 13 years, notwithſtanding his reputation as an author, he was under a neceſſity of petitioning the queen for ſome ſmall ſtipend to ſupport him in his old age. His two letters or petitions to her majeſty on this ſubject are preſerved in manuſcript.

LILLY (William), a noted Engliſh aſtrologer, born in Leiceſterſhire in 1602; where his father not being able to give him more learning than common writing and arithmetic, he reſolved to ſeek his fortune in London. He arrived in 1620, and lived four years as a ſervant to a mantua-maker in the pariſh of St Clements Danes; but then moved a ſtep higher to the ſervice of Mr Wright, maſter of the Salter's company in the Strand, who not being able to write, Lilly among other offices kept his books. In 1627, when his maſter died, he paid his addreſſes to the widow, whom he married with a fortune of 1000l. Being now

Lilly || Libyæum.

his own maſter, he followed the puritanical preachers; and, turning his mind to judicial aſtrology, became pupil to one Evans, a profligate Welſh parſon, in that pretended art. Getting a MS. of the *Ars notitia* of Corn. Agrippa, with alterations, he drank in the doctrine of the magic circle, and the invocation of ſpirits, with great eagerneſs. He was the author of the *Merlinus Anglicus junior*; *The Supernatural Sight*; and *The White King's Prophecy*. In him we have an inſtance of the general ſuperſtition and ignorance that prevailed in the time of the civil war between Char. I. and his parliament: for the king conſulted this aſtrologer, to know in what quarter he ſhould conceal himſelf, if he could eſcape from Hampton court; and general Fairfax, on the other ſide, ſent for him to his army, to aſk him if he could tell by his art, whether God was with them and their cauſe? Lilly, who made his fortune by favourable predictions to both parties, aſſured the general that God would be with him and his army. In 1648, he publiſhed his *Treatiſe of the three Suns* ſeen the preceding winter; and alſo an aſtrological judgment upon a conjunction of Saturn and Mars. This year the council of ſtate gave him in money 50l. and a penſion of 100l. *per annum*, which he received for two years, and then reſigned on ſome diſguſt. In June 1660, he was taken into cuſtody by order of the parliament, by whom he was examined concerning the perſon who cut off the head of king Charles I. The ſame year he ſued out his pardon under the great ſeal of England. The plague raging in London, he removed with his family to his eſtate at Herſham; and in October 1666 was examined before a committee of the houſe of commons concerning the fire of London, which happened in September that year. After his retirement to Herſham, he applied himſelf to the ſtudy of phyſic, and, by means of his friend Mr Aſhmole, obtained from archbiſhop Sheldon a licence for the practice of it. A little before his death he adopted for his ſon, by the name of *Merlin junior*, one Henry Coley, a taylor by trade; and at the ſame time gave him the impreſſion of his almanac, after it had been printed for 36 years. He died in 1681 of a dead palſy. Mr Aſhmole ſet a monument over his grave in the church of Walton upon Thames. His "Obſervations on the Life and Death of Charles late King of England," if we overlook the aſtrological nonſenſe, may be read with as much ſatisfaction as more celebrated hiſtories; Lilly being not only very well informed, but ſtrictly impartial. This work, with the Lives of Lilly and Aſhmole, written by themſelves, were publiſhed in one vol. 8vo, in 1774, by Mr Burman.

LILY, in botany. See LILIUM.

Lily of the Valley. See CONVALLARIA.

LILYBÆUM (anc. geog.), a city of Sicily, ſituated on the moſt weſterly promontory of the iſland of Sicily, and ſaid to have been founded by the Carthaginians on their expulſion from Motya by Dionyſius tyrant of Syracuſe. It is remarkable for three ſieges it ſuſtained; one againſt Dionyſius the tyrant, another againſt Pyrrhus king of Epirus, and the third againſt the Romans. The two firſt failed in their attempts, but the Romans with great difficulty made themſelves maſter of it. No remains of this once ſtately city are now to be ſeen, except ſome aqueducts and temples; though it was ſtanding in Strabo's time.

Lilye, Lima.

LILYE (William,) the grammarian, was born in the year 1466 at Oldham in Hampſhire; and in 1486, was admitted a ſemi-commoner of Magdalen college, in Oxford. Having taken the degree of bachelor of arts, he left the univerſity, and travelled to Jeruſalem. Returning from thence, he continued five years in the iſland of Rhodes, where he ſtudied the Greek language, ſeveral learned men having retired thither after the taking of Conſtantinople. From Rhodes he travelled to Rome; where he improved himſelf in the Greek and Latin languages, under Sulpitius and P. Sabinus. He then returned to London, where for ſome time he taught a private grammar-ſchool, being the firſt perſon who taught Greek in the metropolis. In 1510, when Dr Colet founded St Paul's ſchool, Lilye was appointed the firſt maſter; at which time, it ſeems, he was married and had many children. In this employment he had laboured 12 years, when, being ſeized by the plague, which then raged in London, he died in February 1523, and was buried in the north yard of St Paul's. He had the character of an excellent grammarian, and a ſucceſsful teacher of the learned languages. His principal work is *Breviſſima inſtitutio, ſeu ratio grammatices cognoſcendæ*; Lond. 1513. Reprinted times without number, and commonly called *Lilye's grammar*. The Engliſh rudiments were written by Dr Colet, dean of St Paul's; and the preface to the firſt edition, by cardinal Wolſey. The Engliſh ſyntax was written by Lilye; alſo the rules for the genders of nouns, beginning with *Propria quæ maribus*: and thoſe for the preterperfect tenſes and ſupines, beginning with *As in preſenti*. The Latin ſyntax was chiefly the work of Eraſmus. See Ward's preface to his edition of Lilye's Grammar, 1732.

LIMA, a city of South America, in Peru, of which it is capital, with an archbiſhop's ſee, and an univerſity. It gives its name to the principal audience of Peru; and is ſurrounded with brick-walls, fortified with ſeveral ramparts and baſtions, eight yards high. The ſtreets are handſome, and as ſtraight as a line; but the houſes are generally only one ſtory high, on account of the earthquakes. However, they are pretty enough, and well adorned, having long galleries on the front. One part of the roofs are covered with coarſe linen cloth, and the others only with reeds, which is not inconvenient, becauſe it never rains here; however, the richeſt inhabitants cover theirs with fine mats or beautiful cotton-cloths. There are trees planted all round their houſes, to keep off the heat of the ſun. What the houſes want in height they have in length and depth; for ſome of them are 200 feet long, and proportionably broad, ſo that they have 10 or 12 large apartments on the ground-floor. The royal ſquare is very handſome, and in the middle there is a fountain of bronze, adorned with the image of Fame which ſpouts up water. On the eaſt and weſt ſides are the public ſtructures, which are well built. The river which croſſes Lima forms canals or ſtreams which run to moſt of the houſes, and ſerve to water their gardens, as well as for other uſes. All the churches and convents are extremely rich; and many images of the ſaints are of maſſy gold, adorned with jewels. This city is four

Lima. Limaſſol

miles in length, and two in breadth, and is divided into eight pariſhes; and yet it contains but 28,000 inhabitants, whereof 9000 are Spaniards. They make uſe of mules to draw their coaches with, and of theſe there are about 5000. It is the ſeat of the viceroy, and contains ſeveral courts; as that of the viceroy, of the archbiſhop, of the inquiſition, of the cruſado, and of the wills. Earthquakes are here very frequent; ſome of which have done this city a great deal of damage, particularly that in 1746, whereby it was almoſt deſtroyed: were it not for this, it would be a perfect paradiſe; there being plenty of corn, wine, oil, ſugar, fruits, and flax. The inhabitants are ſo rich, that when the viceroy, who was duke of Palata, and ſent from Spain to Peru in 1672, made his public entrance into this city, the inhabitants paved the ſtreets he was to paſs through with ingots of ſilver. The inhabitants of Lima are very debauched, but at the ſame time extremely ſuperſtitious, and they have a ſtrong belief in the power of charms. About a fourth part of the city are monks and nuns, who are not a jot more chaſte than the reſt; and if any one happens to rival a monk, he is in danger of his life, for they always carry a dagger under their frocks. The nuns are ſuch libertines, that it is hard to find any free from the French diſeaſe, of which they ſometimes die for want of good phyſicians. The greateſt ſinners think they atone for all their faults by hearing a maſs, and kiſſing the robe of St Francis or St Dominic, and then they return to their former practices. It is ſeated on a large, pleaſant, fertile plain, on a ſmall river near the ſea. W. Long. 68. 45. S. Lat. 12. 15.

Mariti's Travels through Cyprus.

LIMASSOL, or Limisso, a town of Cyprus, in the ſouth of the iſland. Of the ancient city nothing but ruins now remain; though it was a celebrated place, even under the government of the dukes. King Richard, the conqueror of the laſt of theſe vaſſals of the empire, razed it in 1191, and it was never afterwards rebuilt. This city originally was the ſame as Amathus, or Amathonte; ſo famous, as Pauſanias tells us, for its temple erected in honour of Venus and Adonis. Amathus was the reſidence of the nine firſt kings of the iſland; and amongſt others of Oneliſtus, who was ſubjected afterwards by the arms of Artabanes, the Perſian general. This city, erected into an archbiſhopric in the time of the Chriſtians, has produced a number of perſonages celebrated for their knowledge and the ſanctity of their lives. In the neighbourhood there are ſeveral copper mines, which the Turks have been forced to abandon. The following lines, in the tenth book of Ovid's Metamorphoſes, prove that they were known in the time of that poet:

> Capta viri forma, non jam Cytherea curat
> Littora, non alto repetit Paphon æquore cinctam,
> Piſcoſamque Gnidon, gravidamque Amathunta metallis.

The place where the new Limaſſol now ſtands, formerly had the name of *Nemoſia*, from the multitude of woods by which it was ſurrounded. Richard king of England having deſtroyed Amathonte, Guy de Luſignan in the 12th century laid the foundations of that new city which the Greeks called *Neopoleos*. The family of Luſignan, who continued to embelliſh and fortify it, built there palaces, and Greek and Latin churches; and made it the ſeat of a biſhop. When the iſland was taken by the Turks in 1570, the Ottoman army entered this city on the 2d of July, and ravaged it without mercy. It was then deſtroyed by the flames; and at preſent it is only a wretched place, in which one can ſcarcely diſtinguiſh any remains of its ancient edifices. It is governed by a commiſſary and a cadi: the latter judges caſes only proviſionally, before they are carried to the ſuperior tribunal of Nicoſia. The harbour is very commodious; and being ſheltered from impetuous winds, it affords a ſafe and calm aſylum to veſſels when overtaken by a ſtorm. The carob tree is here more abundant than any where elſe; and it is from the port of Limaſſol that the greateſt quantity of its fruit is exported. The inhabitants export alſo ſalt, procured from a lake near Salines. Cotton, wheat, barley, and mulberry-trees, are both plentiful and well cultivated in this part of the iſland: the ground alſo produces all kinds of garden ſtuff. The beſt Cyprus wine is made from the vines that grow on the hills of Limaſſol. All the wines of the country are collected in this city to be tranſported to Larnic, where there are the largeſt cellars, and which on that account becomes the natural centre of commerce.

Limax, Limb.

LIMAX, the Slug, or *Naked Snail*; a genus of inſects belonging to the order of vermes molluſca. The body is oblong, fitted for crawling, with a kind of muſcular coat on the upper part; and the belly is plain. They have four tentacula, or horns, ſituated above the mouth, which they extend or retract at pleaſure.—This reptile is always deſtitute of ſhell; but beſides that its ſkin is more clammy and of a greater conſiſtency than that of the ſnail, the black naked ſlug has a furrowed cloak, almoſt as thick and as hard as leather, under which it withdraws its head as within a ſhell. The head is diſtinguiſhed from the breaſt by a black line. It is in its head and back that the ſnail-ſtone is found; which is a ſmall pearled and ſandy ſtone, of the nature of lime ſtones: according to a popular opinion, it cures the tertian ague, if faſtened to the patient's arm. Theſe ſlugs move on ſlowly, leaving every where clammy and ſhining marks of their paſſage. Their coming together is towards the end of ſpring. The organs of generation are placed, as in the ſnail, on the right ſide of the neck. The male implement unfolds with the ſame mechaniſm as the finger of a glove when turned inſide out. They are ſometimes met with hanging in the air with their heads downwards; and their tails, united by a kind of viſcous and thick tie, grappled to the branch of a tree. In this ſituation they remain for three hours, and that is the time of impregnation. They depoſit their eggs in the earth. There are eight ſpecies, diſtinguiſhed entirely by their colour; as the black ſlug, the white ſlug, the reddiſh ſlug, the aſh-coloured ſlug, &c. The black ſlug is hermaphrodite, both ſexes being in each individual, and in the coitus both impregnate and are impregnated at the ſame time.—A black ſlug powdered overwith ſnuff, ſalt, or ſugar, falls into convulſions, caſts forth all its foam, and dies. See Reproduction.

LIMB, in general, denotes the border or edge of a thing; thus we ſay, the limb of a quadrant, of the ſun, of a leaf, &c.

Limb, in anatomy, an appellation given to the extremities of the body, as to the arms and legs.

Limb, *Limbus*, in the church of Rome, is uſed in two different ſenſes. 1. The limb of the patriarchs is

Limbat, Limborch.

said to be the place where the patriarchs waited the redemption of mankind: in this place they ſuppoſe our Saviour's ſoul continued from the time of his death to his reſurrection. 2. The limb of infants dying without baptiſm, is a place ſuppoſed to be diſtinct both from heaven and hell; ſince, ſay they, children dying innocent of any actual ſin, do not deſerve hell; and, by reaſon of their original ſin, cannot be admitted into heaven.

LIMBAT, the name of a periodical wind common in the iſland of Cyprus, and of great ſervice in moderating the heats of the climate, which would otherwiſe be intolerable.

According to the Abbé Mariti, it begins to blow at eight in the morning the firſt day; increaſes as the ſun advances till noon; then gradually weakens, and at three falls entirely. On the ſecond day it ariſes at the ſame hour; but it does not attain its greateſt ſtrength till about one in the afternoon, and ceaſes at four preciſely. On the third day it begins as before; but it falls an hour later. On the five ſucceeding days, it follows the ſame progreſſion as on the third; but it is remarked, that a little before it ceaſes, it becomes extremely violent. At the expiration of five days it commences a new period like the former. By narrowly obſerving the ſea on that ſide from which it is about to blow a little before it ariſes, one may determine what degree of ſtrength it will have during the day. If the horizon is clear, and entirely free from clouds, the wind will be weak, and even almoſt inſenſible; but if it is dark and cloudy, the wind will be ſtrong and violent. This limbat wind, notwithſtanding its utility in moderating the exceſſive heat, often becomes the cauſe of fevers, eſpecially to the Europeans, from their being leſs habituated to the climate, more apt than the natives to ſuffer themſelves to be ſurpriſed by the cool air when in a ſtate of perſpiration. This wind, the falling of which happens an hour ſooner or later, is ſucceeded by a calm, accompanied by a certain moiſture that renders the air ſomewhat heavy. This moiſture diſappears in the evening, being diſſipated by a wind which ariſes every day at that period. This wind is conſidered as a land breeze by the inhabitants of the ſouthern and eaſtern parts of the iſland; but it is called *a ſea breeze* by thoſe in the northern and weſtern, who indeed receive it immediately from the ſea. In ſummer it blows till four o'clock in the morning; and when it ceaſes, it leaves a profound calm, which continues till the hour when the limbat commences. In autumn and winter it never falls till day-break, when it is ſucceeded by other winds, which proceed from the irregularity of the ſeaſon. In ſpring it does not continue longer than midnight; and is then ſucceeded by that happy calm, during which thoſe refreſhing dews are formed that moiſten the earth at ſunriſing. The limbat winds, which ariſe in the beginning of ſummer, ceaſe about the middle of September; and this is the period when the moſt inſupportable heats commence, becauſe their violence is not moderated by the ſmalleſt breeze. They are, however, luckily not of long duration; and about the latter end of October they decreaſe ſenſibly, as the atmoſphere begins to be loaded with watery clouds.

LIMBORCH (Philip), a learned writer among the remonſtrants, born at Amſterdam in 1633. After having made great proficiency in his ſtudies, he was, in 1655, admitted to preach in public, which he did firſt at Haerlem. His ſermons had in them no affected eloquence; but were ſolid, methodical, and edifying. He was choſen miniſter of Goudja; from whence he was called to Amſterdam, where he had the profeſſorſhip of divinity, in which he acquitted himſelf with great reputation till his death, which happened in 1712. He had an admirable genius, and a tenacious memory. He had many friends of diſtinction in foreign parts as well as in his own country. Some of his letters to Mr Locke are printed with thoſe of that celebrated author. He had all the qualifications ſuitable to the character of a ſincere divine, lived an example of every virtue, and preſerved the vigour of his body and mind to a conſiderable age. He wrote many works, which are eſteemed; the principal of which are, 1. *Amica collatio de veritate religionis Chriſtianæ cum erudito Judæo*, in 12mo. 2. A complete body of Divinity, according to the opinions and doctrines of the remonſtrants. 3. A hiſtory of the Inquiſition; which has been tranſlated into Engliſh by Dr Samuel Chandler. Limborch alſo publiſhed the works of the famous Epiſcopius, who was his great-uncle by the mother's ſide.

Limburgh ‖ Limerick.

LIMBURGH-DUCHY, a province of the Auſtrian Netherlands, bounded by the duchy of Juliers on the north and eaſt, by Luxemburgh on the ſouth, and by the biſhopric of Liege on the weſt. It is about 30 miles in length, and 25 in breadth; and conſiſts of good arable and paſture land, with plenty of wood, and ſome iron mines.

LIMBURGH, the capital city of the duchy of Limburgh, in the Auſtrian Netherlands, is ſeated on a ſteep rock near the river Veſſe. This town is ſmall, but pleaſantly ſeated on a hill, with ſhady woods; and conſiſts chiefly of one broad ſtreet, not very well built. It is ſtrong by ſituation, and almoſt inacceſſible; however, it was taken by the French in 1675, and by the confederates under the duke of Marlborough in 1603, for the houſe of Auſtria, to whom it remains by the treaties of Raſtadt and Baden, after having been diſmantled. It is famous for its cheeſe, which is exceeding good. E. Long. 6. 8. N. Lat. 50. 40.

LIME. See QUICKLIME.

LIME-Tree. See CITRUS.

LIME or *LINDEN-Tree.* See TILIA.

LIME-Water. See PHARMACY-*Index.*

LIME, or *Lyme.* See LYME.

LIMERICK, a county of Ireland, in the province of Munſter, is bounded on the eaſt by Tipperary, on the weſt by Kerry, on the north by the river Shannon, and on the ſouth by Cork. It is a fruitful and populous tract, the ſoil requiring little or no manure in moſt places: beſides rich paſture for ſheep and cows, it produces rich crops of all kinds of corn and rape, with ſome hemp. It gave title of earl to the family of Dongan. It contains 375,320 Iriſh plantation acres, about fifty-ſix church livings, though a much greater number of pariſhes, ten baronies, three boroughs, and ſends eight members to parliament. It has ſome clays, furze, fern, and mountain lands, and is famous for good cyder; it has been much benefited by the palatines, who ſettled there and increaſed tillage; they are a laborious independent people, moſtly

Limerick. ly employed in their own farms. This country is well watered by large and ſmall rivers; the Shannon runs at the north ſide of the county, and fertilizes its banks. The firing of the inhabitants is chiefly turf, and the bogs are conveniently ſituated. At Loghill in the weſt of the county, there is a mine of coal or culm, but it is more uſed in kilns than in houſes. There are few lakes except Lough Gur: and the principal hills are Knockgreny, Knockany, Knockfiring, and Tory-hill. The mountains lie weſtward, the higheſt being Knockpatrick or St Patrick's hill. This county is about 45 miles long and 42 broad.

LIMERICK, or *Lough-Meath*, a market-town, a borough, and a biſhop's ſee, now the metropolis of the province of Munſter. It is ſituated on the river Shannon, 94 miles from Dublin; and was the ſtrongeſt fortreſs in the kingdom. Its ancient name was Lunneach; and during the firſt ages it was much frequented by foreign merchants, and after the arrival of the Danes was a place of conſiderable commerce until the 12th century. It was plundered by Mahon, brother of Brien Boromh, after the battle of Sulchoid, in 970; and Brien, in a future period, exacted from the Danes of this city 365 tons of wine as a tribute, which ſhows the extenſive traffic carried on by thoſe people in that article. About the middle of the 6th century, St Munchin erected a church and founded a biſhopric here; which, however, was deſtroyed by the Danes on their taking poſſeſſion of this port in 853, and remained in ruins until their converſion to the Chriſtian faith in the 10th century; at which period the church of St Munchin was rebuilt, and the biſhopric eſtabliſhed. Donald O'Brien, about the time of the arrival of the Engliſh, founded and endowed the cathedral; and Donat O'Brien, biſhop of Limerick, in the 13th century, contributed much to the opulence of the ſee. About the cloſe of the 12th century, the biſhoprick of Innis-Cathay was united to that of Limerick. It was beſieged by king William III. in the year 1690; and though there was no army to aſſiſt it, the king was obliged to raiſe the ſiege. In the year 1691, it was again beſieged by the Engliſh and Dutch on the 21ſt of September; and it was obliged to ſurrender on the 13th of October following, not without the loſs of abundance of men; however, the garriſon had very honourable and advantageous conditions, being permitted to retire where they thought fit, and the Roman-catholics by theſe articles were to be tolerated in the free exerciſe of their religion. Within a century this place was reckoned the ſecond city in Ireland; at preſent it has loſt its rank; not becauſe it thrives leſs, but becauſe Cork thrives more. It is compoſed of the Iriſh and Engliſh town; the latter ſtands on the King's iſland, formed by the river Shannon. The town is three miles in circumference, having weekly markets on Wedneſday and Saturday, and fairs on Eaſter Tueſday, 1ſt July, 4th Auguſt, and 12th December. There is a privilege annexed to the fair held on 4th Auguſt, that, during 15 days, no perſon can be arreſted in the city or liberties, on any proceſs iſſuing out of the Tholſel court of Limerick. Ardfert and Achadoe, in the county of Kerry, are united to the biſhoprick of Limerick. This city returns two members to parliament; and gives title of viſcount to the family of Hamilton. It is governed by a mayor, ſheriffs, recorder, aldermen, and burgeſſes; there is alſo a barrack and a military governor and town-major: it had ſome time the privilege of coinage; and different parliaments have been held there. The town was formerly entirely walled in; and in 1760, there were 17 of the city gates ſtanding; but to the great improvement of the place they are now all demoliſhed, except the water-gate of king John's caſtle. The linen, woollen, and paper manufactures, are carried on here to great extent, and the export of proviſions is very conſiderable. Here are many charitable hoſpitals and handſome public buildings, beſides the cathedral and other churches. A charter was granted to this city by king John, and confirmed in ſucceeding reigns. Dr Campbell obſerves, that as you approach Limerick, the grounds grow rich and exquiſitely beautiful; the only diſagreeable matter is, that the ſituation renders the air moiſt, and conſequently rather unwholeſome to ſtrangers. About ſix miles from this is the famous Caſtleconnel-ſpa. Limerick is 50 miles from Cork, 50 from Galway, and 73 from Waterford. It appears that Limerick obtained the privilege of having mayors 10 years before that right was allowed to the citizens of London. It was before governed by provoſts, of which the firſt was John Spafford, in 1195 and 1197; during the provoſtſhip of Henry Troy a charter was granted, 9 Richard I. whereby the citizens were allowed to chooſe mayors and bailiffs, Adam Servant, in 1198, being the firſt mayor. It continued to be governed by mayors and bailiffs, until the office of bailiff was changed into that of ſheriff, in 1609.

LIMERICK is alſo the name of a fair-town in the county of Wexford and province of Leinſter; the fairs are four in the year.

Limington || Limning. LIMINGTON, a town of Hampſhire in England. See LYMINGTON.

LIMIT, in a reſtrained ſenſe, is uſed by mathematicians for a determined quantity to which a variable one continually approaches; in which ſenſe, the circle may be ſaid to be the limit of its circumſcribed and inſcribed polygons. In algebra, the term *limit* is applied to two quantities, one of which is greater and the other leſs than another quantity; and in this ſenſe it is uſed in ſpeaking of the limits of equations, whereby their ſolution is much facilitated.

LIMME, a town of Kent, in England, near Hithe, and four miles from Romney, was formerly a port, till choaked up by the ſands; and though it is thereby become a poor town, yet it has the horn and mace and other tokens left of its ancient grandeur, and uſed to be the place where the lord warden of the cinque-ports was ſworn at his entrance upon his office. The Roman road from Canterbury, called *Stane-ſtreet*, ended here; and from the brow of its hill may be ſeen the ruinous Roman walls almoſt at the bottom of the marſhes. Here formerly was a caſtle, now converted into a farm-houſe. When or by whom this edifice was erected is not known. It has, however, great marks of antiquity; as has alſo the adjoining church, in which are ſeveral old tombſtones with croſſes on them.

LIMNING, the art of painting in water-colours, in contradiſtinction to painting which is done in oil-colours.

Limning is much the more ancient kind of painting

Limning ‖ Linacre.

ing. Till a Flemiſh painter, one John van Eyck, better known by the name of *John of Bruges*, found out the art of painting in oil, the painters all painted in water and in freſco, both on their walls, on wooden boards, and elſewhere. When they made uſe of boards, they uſually glued a fine linen cloth over them, to prevent their opening; then laid on a ground of white; laſtly, they mixed up their colours with water and ſize, or with water and yolks of eggs, well beaten with the branches of a fig-tree, the juice whereof thus mixed with the eggs; and with this mixture they painted their pieces.

In limning, all colours are proper enough, except the white made of lime, which is only uſed in freſco. The azure and ultramarine muſt always be mixed with ſize or gum; but there are always applied two layers of hot ſize before the ſize-colours are laid on: the colours are all ground in water each by itſelf; and, as they are required in working, are diluted with ſize-water. When the piece is finiſhed, they go over it with the white of an egg well beaten; and then with varniſh, if required.

To limn, or draw a face in colours: Having all the materials in readineſs, lay the prepared colour on the card even and thin, free from hairs and ſpots over the place where the picture is to be. The ground being laid, and the party placed in a due poſition, begin the work, which is to be done at three ſittings. At the firſt you are only to dead-colour the face, which will require about two hours. At the ſecond ſitting, go over the work more curiouſly, adding its particular graces or deformities. At the third ſitting, finiſh the whole; carefully remarking whatever may conduce to render the piece perfect, as the caſt of the eyes, moles, ſcars, geſtures, and the like.

LIMOGES, an ancient and conſiderable town of France, in the province of Guienne, and capital of Limoſin, with a biſhop's ſee. It is a trading place, and its horſes are in great eſteem. It is ſeated on the river Vienne, in E. Long. 1. 22. N. Lat. 42. 48.

LIMOSIN, a province of France, bounded on the north by La Marche, on the eaſt by Auvergne, on the ſouth by Quercy, and on the weſt by Perigord and Angoumois. It is divided into the Upper and Lower; the former of which is very cold, but the latter more temperate. It is covered with foreſts of chefnut-trees; and contains mines of lead, copper, tin, and iron; but the principal trade conſiſts in cattle and horſes.

LIMPET. See PATELLA.

LIMPURG, a barony of Germany, in the circle of Franconia, included almoſt entirely within Suabia, and ſeated to the ſouth of Hall in Suabia. It is about 15 miles long, and eight broad. Gaildorf and Shonburg, near which is the caſtle of Limpurg, are the principal places.

LIMPURG, a town of Germany, in the electorate of Triers or Treves, and in Wetteravia, formerly free and imperial, but now ſubject to the electorate of Treves. It is ſeated on the river Lhon. E. Long. 8. 13. N. Lat. 50. 18.

LINARIA, in ornithology. See FRINGILLA.

LINACRE (Thomas), phyſician, was born at Canterbury about the year 1460, and there educated under the learned William Selling: thence he removed to Oxford, and in 1484 was choſen fellow of All-Souls college. Tilly, *alias* Selling, his former inſtructor, being at this time appointed ambaſſador from King Henry VII. to the court of Rome, Mr Linacre accompanied him to Italy, where he attained the higheſt degree of perfection in the Greek and Latin languages. At Rome, he applied himſelf particularly to the ſtudy of Ariſtotle and Galen, in the original. On his return to Oxford, he was incorporated doctor of phyſic, and choſen public profeſſor in that faculty. But he had not been long in England, before he was commanded to court by King Henry VII. to attend the young Prince Arthur as his tutor and phyſician. He was afterwards appointed phyſician to the king, and, after his death, to his ſucceſſor Henry VIII. Dr Linacre founded two medical lectures at Oxford, and one at Cambridge; but that which moſt effectually immortalized his name among the faculty, is his being the firſt founder of the college of phyſicians in London. He beheld with vexation the wretched ſtate of phyſic in thoſe times; and, by an application to Cardinal Wolſey, obtained a patent in 1518, by which the phyſicians of London were incorporated. The intention of this corporation was to prevent illiterate and ignorant medicaſters from practiſing the art of healing. Dr Linacre was the firſt preſident, and held the office as long as he lived. Their meetings were in his own houſe in Knight-rider ſtreet, which houſe he bequeathed to the college. But our doctor, when he was about the age of 50, took it into his head to ſtudy divinity; entered into orders; and was collated, in 1509, to the rectory of Merſham. In the ſame year he was inſtalled prebendary of Wells, in 1518 prebendary of York, and in the following year was admitted precentor of that cathedral. This, we are told, he reſigned for other preferments. He died of the ſtone in the bladder in October 1524, aged 64; and was buried in St Paul's. Thirty-three years after his death, Doctor John Caius cauſed a monument to be erected to his memory, with a Latin inſcription, which contains the outlines of his life and character. He was a man of great natural ſagacity, a ſkilful phyſician, a profound grammarian, and one of the beſt Greek and Latin ſcholars of his time. Eraſmus in his epiſtles ſpeaks highly of the doctor's tranſlations from Galen, preferring them even to the original Greek. His works are, 1. *De emendata ſtructura Latini ſermonis, libri ſex*; London, printed by Pynſon, 1524, 8vo, and by Stephens, 1527, 1532. 2. The rudiments of grammar, for the uſe of the princeſs Mary, printed by Pynſon. Buchanan tranſlated it into Latin; Paris, 1536. He likewiſe tranſlated into very elegant Latin, ſeveral of Galen's works, which were printed chiefly abroad at different times. Alſo *Procli Diadochi ſphæra*, tranſlated from the Greek; Venet. 1499, 1500.

Linacre, Lincoln.

LINCOLN, a city of England, and capital of a county of the ſame name, is diſtant 132 miles from London. It ſtands on the ſide of a hill; at the bottom of which runs the river Withum in three ſmall channels, over which are ſeveral bridges. The old *Lindum* of the Britons, which ſtood on the top of the hill, as appears from the veſtiges of a rampart, and deep ditches ſtill remaining, was taken and demoliſhed by the Saxons; who built a town upon the ſouth ſide of the hill down to the river ſide, which was ſeveral times

Lincoln. times taken by the Danes, and as often retaken by the Saxons. In Edward the Confeſſor's time, it appears, from Doomſday-book, to have been a very conſiderable place; and in the time of the Normans, Malmſbury ſays, it was one of the moſt populous cities in England. William I. built a caſtle upon the ſummit of the hill above the town. The dioceſe, though the biſhopric of Ely was taken out of it by Henry II. and thoſe of Peterborough and Oxford by Henry VIII. is ſtill vaſtly large, containing the counties of Leiceſter, Huntingdon, Bedford, and part of Bucks, making 1255 pariſhes. Though the other churches are mean, the cathedral or minſter is a moſt magnificent piece of Gothic architecture. Here is a prodigious large bell, called *Tom of Lincoln*, which is near five ton in weight, and 23 feet in compaſs. The hill on which the church ſtands is ſo high, and the church itſelf ſo lofty, that it may be ſeen 50 miles to the north, and 30 to the ſouth. Beſides other tombs, it contains one of braſs, in which are the entrails of Queen Eleanor, wife to Edward I. It is ſaid there were anciently 52 churches, which are now reduced to 14. Such is the magnificence and elevation of the cathedral, that the monks thought the ſight of it muſt be very mortifying to the devil; whence it came to be ſaid of one who was diſpleaſed, *that he looked like the devil over Lincoln*. The declivity on which the city is built being ſteep, the communication betwixt the upper and lower town is very troubleſome, and coaches and horſes are obliged to make a compaſs.

King Edward III. made this city a ſtaple for wool, leather, lead, &c. It was once burnt; once beſieged by King Stephen, who was here defeated and taken priſoner; and once taken by Henry III. from his rebellious barons. It abounded heretofore with monaſteries and other religious houſes. There is a great pool here, formed by the river on the weſt ſide of it, called *Swan-Pool*, becauſe of the multitude of ſwans on it. The Romans north gate ſtill remains entire, by the name of *Newport-Gate*. It is one of the nobleſt of this ſort in Britain. It is a vaſt ſemicircle of ſtones of very large dimenſions laid without mortar, connected only by their uniform ſhape. This magnificent arch is 16 feet in diameter, the ſtones are four feet thick at the bottom. It ſeems to have a joint in the middle, not a key-ſtone; and on both ſides, towards the upper part, are laid horizontal ſtones of great dimenſions, ſome 10 or 12 feet long. This arch riſes from an impoſt of large mouldings, which are not perceivable now; there are alſo divers fragments of the old Roman wall. Over againſt the caſtle is an entrenchment caſt up by king Stephen; and here are carved the arms of John of Gaunt, duke of Lancaſter, who lived here like a king, and had a mint. The city has a communication with the Trent, by a canal called the Foſs-dyke. In the centre of the ruined old caſtle there is a handſome modern ſtructure for holding the aſſizes. Its walls are almoſt entire, and very ſubſtantial: the Keep or principal tower is ſituated on a high and very ſteep mount, which yet continues in its original ſtate, but the remains of the tower on it are only five or ſix yards high. The outer walls of the caſtle are of very conſiderable height, which appear ſtill higher than they really are from their lofty ſituation and the moat below them. The great gateway is ſtill entire. This city is a county of itſelf, and has a viſcountial juriſdiction for 20 miles round, which is a privilege that no other city in England can equal. It now conſiſts principally of one ſtreet above two miles long, well paved, beſides ſeveral croſs and parallel ſtreets well peopled. Here are ſome very handſome modern buildings, but more antique ones; upon the whole, it has an air of ancient greatneſs, ariſing in a great meaſure from the number of monaſtic remains, moſt of which are now converted into ſtables, out-houſes, &c. Upon the hill, in the caſtle are the ruins of the biſhop's palace, and other ruins of ancient grandeur and magnificence. The city is ſupplied with water by ſeveral conduits, among which is a modern one, ſomewhat in the pyramidical ſtyle, enriched with ſculpture. It is governed by a mayor, twelve aldermen, two ſheriffs, a recorder, four chamberlains, a ſword-bearer, four coroners, and above forty common-council men. Here are four charity ſchools, where 120 poor children are taught by the widows of clergymen. The neighbouring courſe is noted for its frequent horſe-races. On the down of Lincoln, towards Boſton, that rare fowl the buſtard is ſeen ſometimes, as well as on Saliſbury-Plain. Lincoln-Heath extends above 50 miles, viz. from Sleaford and Ancaſter ſouth to the Humber north, though it is but three or four miles over where broadeſt. Five miles from Boſton on this extenſive heath, the late Lord Le Deſpenſer built a few years ago a tower for the direction of ſtrangers. It is a lofty ſquare building with a ſtaircaſe, which terminates in a flat roof, and round the baſe is a ſquare court-yard. Great part of this extenſive heath is lately incloſed. The markets here are Tueſdays and Fridays; and there are four fairs in the year. We read that David king of Scots met king John here, on the 22d of November, in the third year of his reign, and performed homage to him on a hill without the city, for his Engliſh territories, in preſence of the archbiſhops of Canterbury, York, and Raguſa, 13 biſhops, and a vaſt number of temporal lords and knights. King Henry VII. kept his court here at Eaſter in 1486. The Jews were once its chief inhabitants, till they were forced to remove, after having impiouſly crucified the child of one Grantham, and thrown it into a well, to this day called *Grantham's Well*. Lincoln has given the title of earl to the family of Clinton ever ſince the reign of Queen Elizabeth. W. Long. 27. 1. N. Lat. 53. 16. Lincoln.

Lincoln-Shire, a maritime county of England, 77 miles in length and 48 in breadth, is bounded on the eaſt by the German ocean, on the weſt by Nottinghamſhire, on the north by Yorkſhire, on the ſouth by Rutlandſhire, Northamptonſhire, and Cambridgeſhire. It contains 4590 houſes, 24,340 inhabitants, 631 pariſhes, and 31 market towns, whereof five ſend members to parliament, which, with two for the county, make twelve in all. The principal rivers are the Humber, the Trent, the Witham, the Nenn, the Welland, the Ankham, and the Dun. It is divided into three parts, Lindſay, Keſtoven, and Holland; the air of which laſt is unwholeſome and foggy, on acconnt of the fens and large marſhes. The ſoil of the north and weſt parts is very fertile, and abounds in corn and paſtures. The eaſt and ſouth parts are not ſo proper for corn; but then they ſupply them with fiſh and fowl in great plenty, particularly ducks and geeſe. Lincoln

Lindesfarn || Lindsey.

is the principal town. By the late inland navigation, this county has communication with the rivers Merſey, Dee, Ribble, Ouſe, Darwent, Severn, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles through diverſe counties.

LINDESFARN, or LANDISFARN. See *Holy-Iſland*.

LINDSAY (Sir David), a celebrated Scots poet, was deſcended of an ancient family, and born in the reign of king James IV. at his father's ſeat called the *Mount*, near Cupar in Fifeſhire. He was educated at the univerſity of St Andrew's; and, after making the tour of Europe, returned to Scotland in the year 1514. Soon after his arrival, he was appointed gentleman of the bed-chamber to the king, and tutor to the young prince, afterwards James V. From the verſes prefixed to his dream, we learn that he enjoyed ſeveral other honourable employments at court: but, in 1533, he was deprived of all his places, except that of *Lion king at arms*, which he held to the time of his death. His diſgrace was moſt probably owing to his invectives againſt the clergy, which are frequent in all his writings. After the deceaſe of king James V. Sir David became a favourite of the earl of Arran, regent of Scotland; but the abbot of Paiſley did not ſuffer him to continue long in favour with the earl. He then retired to his paternal eſtate, and ſpent the remainder of his days in rural tranquillity. He died in the year 1553. His poetical talents, conſidering the age in which he wrote, were not contemptible; but he treats the Romiſh clergy with great ſeverity, and writes with ſome humour: but, whatever merit might be formerly attributed to him, he takes ſuch licentious liberties with words, ſtretching, or carving them for meaſure or rhime, that the Scots have a proverb, when they hear an unuſual expreſſion, that, *There is nae ſic a word in a' Davie Lindſay*. Mackenzie tells us, that his comedies were ſo facetious, that they afforded abundance of mirth. Some fragments of theſe comedies are ſtill preſerved in manuſcript. He is ſaid to have alſo written ſeveral tragedies, and to have firſt introduced dramatic poetry into Scotland. One of his comedies was played in 1515. Mackenzie ſays, he underſtood nothing of the rules of the theatre. He was cotemporary with John Heywood, the firſt Engliſh dramatic poet. His poems are printed in one ſmall volume; and fragments of his plays, in manuſcript, are in Mr William Carmichael's collection.

LINDSEY, the third and largeſt diviſion of the county of Lincolnſhire in England. On the eaſt and north it is waſhed by the ſea, into which it runs out with a large front; on the weſt it has Yorkſhire and Nottinghamſhire, from which it is parted by the rivers Trent and Dun; on the ſouth it has Keſtevan, from which it is ſeparated by the river Witham and the Foſs-dyke, which is ſeven miles long, and was cut by Henry I. between the Witham and the Trent, for the convenience of carriage in thoſe parts. It had its name from Lincoln, the capital of the county, which ſtands in it, and by the Romans called *Lindum*, by the Britons *Lindcoit*, by the Saxons *Lindo-collyne*, probably from its ſituation on a hill, and the lakes or woods that were anciently thereabouts; but the Normans called it *Nichol*. It gives title of earl and marquis to the duke of Ancaſter.

LINDUS, (anc. geog.), a town of Rhodes, ſituated on a hill on the weſt ſide of the iſland. It was built by Tlepolemus the ſon of Hercules, according to Diodorus Siculus; by one of the Heliades, grandſons of the Sun, named *Lindus*, according to Strabo. It was the native place of Cleobulus, one of the wiſe men. Here we ſee the famous temple of Lindian Minerva, which was built be the daughters of Danaus. Cadmus enriched this temple with many ſplendid offerings. The citizens dedicated and hung up here the ſeventh of Pindar's Olympic odes, written in letters of gold. The ruins of that ſuperb edifice are ſtill to be ſeen on the top of an high hill which overlooks the ſea. Some remains of the walls, conſiſting of ſtones of an enormous ſize, ſtill ſhow it to have been built in the Egyptian ſtyle. The pillars and other ornaments have been carried off. On the moſt elevated peak of the rock are the ruins of a caſtle, which may have ſerved as a fortreſs to the city. Its circumference is very extenſive, and is filled with rubbiſh. Lindus, Line.

Lindo, the modern city, ſtands at the foot of the hill. A bay, of conſiderable wideneſs and depth, ſerves as a harbour to the city. Ships find good anchorage there in twenty fathoms water. They are ſafely ſheltered from the ſouth-weſt winds, which conſtantly prevail through the ſevereſt ſeaſon of the year. In the beginning of winter, they caſt anchor off a ſmall village named Maſſary. Before the building of Rhodes, Lindus was the harbour which received the fleets of Egypt and Tyre. It was enriched by commerce. Mr Savary obſerves, that a judicious government, by taking advantage of its harbour and happy ſituation, might yet reſtore it to a flouriſhing ſtate.

LINE, in geometry, a quantity extended in length only, without any breadth or thickneſs. It is formed by the flux, or motion of a point. See FLUXIONS, and GEOMETRY.

LINE, in the art of war, is underſtood of the diſpoſition of an army ranged in order of battle, with the front extended as far as may be, that it may not be flanked.

Line of Battle, is alſo underſtood of a diſpoſition of the fleet in the day of engagement; on which occaſion the veſſels are uſually drawn up as much as poſſible in a ſtraight line, as well to gain and keep the advantage of the wind as to run the ſame board. See *Naval* TACTICS.

Horizontal LINE, in geography and aſtronomy, a line drawn parallel to the horizon of any part of the earth.

Equinoctial LINE, in geography, is a great circle on the earth's ſurface, exactly at the diſtance of 90° from each of the poles, and of conſequence biſecting the earth in that part. From this imaginary line, the degrees of longitude and latitude are counted.—In aſtronomy, the equinoctial line is that circle which the ſun ſeems to deſcribe round the earth on the days of the equinox in March and September. See ASTRONOMY and GEOGRAPHY.

Meridian LINE, is an imaginary circle drawn thro' the two poles of the earth and any part of its ſurface. See GEOGRAPHY, n° 29.

Ship of the LINE, a veſſel large enough to be drawn up in the line, and to have a place in a ſea-fight.

Line || Linen.

Line, in genealogy, a ſeries or ſucceſſion of relations in various degrees, all deſcending from the ſame common father. See Descent.

Line, alſo denotes a French meaſure containing the 12th part of an inch, or the 144th part of a foot. Geometricians conceive the line ſubdivided into ſix points. The French line anſwers to the Engliſh barley-corn.

Fiſhing Line. See *Fishing Line.*

Lines, in heraldry, the figures uſed in armories to divide the ſhield into different parts, and to compoſe different figures. Theſe lines, according to their different forms and names, give denomination to the pieces or figures which they form, except the ſtraight or plain lines. See Heraldry.

LINEA alba, in anatomy, the concourſe of the tendons of the oblique and tranſverſe muſcles of the abdomen; dividing the abdomen in two, in the middle. It is called *linea*, line, as being ſtraight; and *alba*, from its colour, which is white.—The *linea alba* receives a twig of a nerve from the intercoſtals in each of its digitations or indentings, which are viſible to the eye, in lean perſons eſpecially.

LINEAMENT, among painters, is uſed for the outlines of a face.

LINEAR numbers, in mathematics, ſuch as have relation to length only; ſuch is a number which repreſents one ſide of a plain figure. If the plain figure be a ſquare, the linear figure is called a *root*.

Linear Problem; that which may be ſolved geometrically by the interſection of two right lines. This is called a *ſimple problem*, and is capable but of one ſolution.

LINEN, in commerce, a well-known kind of cloth chiefly made of flax.—Linen was not worn by the Jews, Greeks, or Romans, as any part of their ordinary dreſs. Under tunicks of a finer texture ſupplied the place of ſhirts: Hence the occaſion for frequent bathing. Alexander Severus was the firſt emperor who wore a ſhirt: but the uſe of ſo neceſſary a garment did not become common till long after him.

The linen manufacture was probably introduced into Britain with the firſt ſettlements of the Romans. The flax was certainly firſt planted by that nation in the Britiſh ſoil. The plant itſelf indeed appears to have been originally a native of the eaſt. The woollen drapery would naturally be prior in its origin to the linen; and the fibrous plants from which the threads of the latter are produced, ſeems to have been firſt noticed and worked by the inhabitants of Egypt. In Egypt, indeed, the linen manufacture appears to have been very early: for even in Joſeph's time it had riſen to a conſiderable height. From the Egyptians the knowledge of it proceeded probably to the Greeks, and from them to the Romans. Even at this day the flax is imported among us from the eaſtern nations; the weſtern kind being merely a degenerate ſpecies of it.

In order to ſucceed in the linen manufacture, one ſet of people ſhould be confined to the ploughing and preparing the ſoil, ſowing and covering the ſeed, to the weeding, pulling, rippling, and taking care of the new ſeed, and watering and dreſſing the flax till it is lodged at home: others ſhould be concerned in the drying, breaking, ſcutching, and heckling the flax, to fit it for the ſpinners; and others in ſpinning and reeling it, to fit it for the weaver: others ſhould be concerned in taking due care of the weaving, bleaching, beetling, and finiſhing the cloth for the market. It is reaſonable to believe, that if theſe ſeveral branches of the manufacture were carried on by diſtinct dealers in Scotland and Ireland, where our home-made linens are manufactured, the ſeveral parts would be better executed, and the whole would be afforded cheaper, and with greater profit. Linen.

Staining of Linen. Linen receives a black colour with much more difficulty than woollen or cotton. The black ſtruck on linen with common vitriol and galls, or logwood, is very periſhable, and ſoon waſhes out.—Inſtead of the vitriol, a ſolution of iron in ſour ſtrong beer is to be made uſe of. This is well known to all the calico-printers; and by the uſe of this, which they call their *iron liquor*, and madder-root, are the blacks and purples made which we ſee on the common printed linens. The method of making this iron-liquor is as follows: A quantity of iron is put into the ſour ſtrong beer; and, to promote the diſſolution of the metal, the whole is occaſionally well ſtirred, the liquor occaſionally drawn off, and the ruſt beat from the iron, after which the liquor is poured on again. A length of time is required to make the impregnation perfect; the ſolution being reckoned unfit for uſe till it has ſtood at leaſt a twelvemonth. This ſolution ſtains the linen of a yellow, and different ſhades of buff-colour; and is the only known ſubſtance by which theſe colours can be fixed on linen. The cloth ſtained deep with the iron liquor, and afterwards boiled with madder, without any other addition, becomes of the dark colour which we ſee on printed linens and cottons; which, if not a perfect black, has a very near reſemblance to it. Others are ſtained paler with the ſame liquor diluted with water, and come out purple.

Linen may alſo be ſtained of a durable purple by means of ſolution of gold in aqua regia. The ſolution for this purpoſe ſhould be as fully ſaturated as poſſible; it ſhould be diluted with three times its quantity of water; and if the colour is required deep, the piece, when dry, muſt be repeatedly moiſtened with it. The colour does not take place till a conſiderable time, ſometimes ſeveral days, after the liquor has been applied: to haſten its appearance, the ſubject ſhould be expoſed to the ſun and free air, and occaſionally removed to a moiſt place, or moiſtened with water.—When ſolution of gold in aqua regia is ſoaked up in linen cloths, the metal may be recovered by drying and burning them.

The anacardium nut, which comes from the Eaſt-Indies, is remarkable for its property of ſtaining linen of a deep black colour, which cannot be waſhed out either with ſoap or alkaline ley. The ſtain is at firſt of a reddiſh-brown, but afterwards turns to a deep black on expoſure to the air. The caſhew-nut, called the *anacardium of the Weſt-Indies*, differs from the oriental anacardium in its colouring quality. The juice of this nut is much paler than the other, and ſtains linen or cotton only of a browniſh colour; which indeed is very durable, but does not at all change towards blackneſs.—There are, however, trees, natives of our own colonies, which appear to contain juices of the

Linen. same nature with those of India. Of this kind are several, and perhaps the greater number, of the species of the † See *Rhus.* toxicodendron or poison-tree †. Mr Catesby, in his history of Carolina, describes one called there the *poison-ash*, from whose trunk flowed a liquid as black as ink, and supposed to be poisonous; which reputed poisonous quality has hitherto prevented the inhabitants from collecting or attempting to make any use of it. In the Philosophical Transactions for the year 1755, the abbé Mazeas gives an account of three sorts of the toxicodendron raised in a botanic garden in France, containing in their leaves a milky juice, which in drying became quite black, and communicated the same colour to the linen on which it was dropped. The linen thus stained was boiled with soap, and came out without the least diminution of colour; nor did a strong ley of wood-ashes make any change in it. Several of these trees have been planted in the open ground in England, and some still remain in the bishop of London's garden at Fulham.

That species called by Mr Miller the *true lac tree*, was found by Dr Lewis to have properties of a similar kind. It contains in its bark, and the pedicles and ribs of the leaves, a juice somewhat milky, which soon changed in the air to a reddish-brown, and in two or three hours to a deep blackish or brownish-black colour: wherever the bark was cut or wounded, the incision became blackish; and on several parts of the leaves the juice had spontaneously exsuded, and stained them of the same colour. This juice dropped on linen gave at first little or no colour, looking only like a spot of oil; but, by degrees, the part moistened with it darkened in the same manner as the juice itself. On washing and boiling the linen with soap, the stain not only was not discharged, but seemed to have its blackness rather improved; as if a brown matter, with which the black was manifestly debased, had been in part washed out, and left the black more pure.

As the milky juice of some of our common plants turn dark-coloured or blackish in drying, the Doctor was induced to try the effects of several of them on linen. The milks of wild-poppies, garden-poppies, dandelion, hawk-weed, and sow-thistle, gave brown or brownish-red stains, which were discharged by washing with soap; the milks of the fig-tree, of lettuces, and of different kinds of spurges, gave no colour at all. The colourless juice which issues from hop-stalks when cut, stains linen of a pale-reddish, or brownish-red, extremely durable; the colour was deepened by repeated applications of the juice, but it never made any approach to blackness. The juice of sloes gave likewise a pale-brownish stain, which by repeated washings with soap, and being wetted with strong solution of alkaline salt, was darkened to a deeper brown: on baking the sloes, their juice turns red; and the red stain which it then imparts to linen is, on washing with soap, changed to a pale-bluish, which also proves durable. These colours could not be deepened by repeated applications of the juice. The sloes were tried in different states of maturity, from the beginning of September to the middle of December, and the event was always nearly the same.

In the fifth volume of Linnæus's *Amœnitates Academicæ*, mention is made of a black colour obtained from two plants which grow spontaneously in Britain; the one is the *actæa spicata*, herb-christopher, or bane-berries; the other the *erica baccifera nigra*, black-berried heath, crow-berries, or crake-berries. The juice of the bane-berries, boiled with alum, is said to yield a black ink; and the heath-berries, boiled also with alum, to dye linen of a purplish black.

Ling ‖ Linlithgow.

Linen flowered with Gold-leaf. Dr Lewis informs us of a late manufacture established in London for embellishing linen with flowers and ornaments of gold-leaf. The linen, he says, looks whiter than most of the printed linens; the gold is extremely beautiful, and bears washing well. The Doctor informs us, that he had seen a piece which he was credibly informed had been washed three or four times, with only the same precautions which are used for the finer printed linens; and on which the gold continued entire, and of great beauty.—Concerning the process used in this manufacture, he gives us no particulars.

Fossile Linen, is a kind of amianthus, which consists of flexible, parallel, soft fibres, and which has been celebrated for the uses to which it has been applied, of being woven, and forming an *incombustible cloth*. Paper also, and wicks for lamps, have been made of it. See Amianthus and Asbestos.

LING, in zoology. See Gadus.

LINGEN, a strong town of Germany, in the circle of Westphalia, and capital of a county of the same name. It belongs to the king of Prussia; and is situated on the river Embs, in E. Long. 7. 30. N. Lat. 52. 32.

LINGELBACH (John), an excellent painter, born at Franckfort on the Maine in 1625. He first learned the art in Holland, but perfected himself at Rome; where he studied till he was 25 years of age, when he settled at Amsterdam. His usual subjects are fairs, mountebanks, sea-pieces, and landscapes, which he composed and executed exceeding well: his landscapes are enriched with antiquities, animals, and elegant figures; his sea-fights are full of expression, exciting pity and terror, and all his objects are well designed. He had an uncommon readiness in painting figures and animals, on which account he was employed by several eminent artists to adorn their landscapes with such objects; and whatever he inserted in the works of other masters, were always well adapted, and produced an agreeable effect. He died in 1687.

LINIMENT, in pharmacy, a composition of a consistence somewhat thinner than an unguent, and thicker than an oil used for anointing different parts of the body in various intentions.——The materials proper for composing liniments are, fats, oil, balsams, and whatever enters the composition of unguents and plasters.

LINLITHGOW, the chief town of West Lothian in Scotland. It is supposed to be the *Lindum* of Ptolemy; and to take its name from its situation on a lake, which the word *Lin* or *Llyn* signifies.——It is distant 16 miles from Edinburgh, and is a royal borough and seat of a presbytery. It contains between three and four thousand souls; and carries on a considerable trade in dressing of white leather, which is sent abroad to be manufactured. It also employs many hands in dressing of flax; also in wool-combing, the wool for which is

Linlithgow, Linnæus.

brought from the borders. Its port was formerly *Blackneſs*; but ſince the decline of that place, *Burrowſtounneſs*, about two miles diſtant from Linlithgow The town conſiſts of one open ſtreet, from whence lanes are detached on both ſides; the houſes are built of ſtone, tolerably neat and commodious; and the place is adorned with ſome ſtately public edifices. The palace, built, as Sibbald ſuppoſed, on the ſite of a Roman ſtation, forms a ſquare with towers at the corners, and ſtands on a gentle eminence, with the beautiful loch behind it to the weſt. It was one of the nobleſt of the royal reſidences; and was greatly ornamented by James V. and VI. Within the palace is a handſome ſquare; one ſide of which is more modern than the others, having been built by James VI. and kept in good repair till 1746, when it was accidentally damaged by the king's forces making fires on the hearths, by which means the joiſts were burnt. A ſtone ornamented fountain in the middle of the court was deſtroyed at the ſame time. The other ſides of the ſquare are more ancient. In one is a room ninety-five feet long, thirty feet ſix inches wide, and thirty-three high. At one end is a gallery with three arches, perhaps for muſic. Narrow galleries run quite round the old part, to preſerve communications with the rooms; in one of which the unfortunate Mary Stuart firſt ſaw light. On the north ſide of the high ſtreet, on an eminence eaſt of the palace, ſtands St Michael's church; a handſome ſtructure, where James V. intended to have erected a throne and twelve ſtalls for the ſovereign and knights of the order of St Andrew. In the market-place is another fountain of two ſtories with eight ſpouts, and ſurmounted like the former with an imperial crown. In one of the ſtreets is ſhown the gallery whence the regent Murray was ſhot. Here was a houſe of Carmelites, founded by the townſpeople in 1290, deſtroyed by the reformers 1559. The family of Livingſton, who take the title of earl from this place, are hereditary keepers of this palace, as alſo bailiffs of the king's bailifry, and conſtables of Blackneſs caſtle; but by their concern in the rebellion of 1715 all theſe honours with their eſtate were forfeited to the crown. Sir James Livingſton, ſon of the firſt earl by marriage with a daughter of Callendar, was created earl of Callendar by Charles I. 1641, which title ſunk into the other.

LINNÆUS (Sir Charles), a celebrated botaniſt and natural hiſtorian, was born on May 24. 1707, in a village called *Roeſhult* in Smaland, where his father, Nicolas Linnæus, was then vicar, but afterwards preferred to the curacy of Stenbrohult. We are told, that on the farm where Linnæus was born, there yet ſtands a large lime-tree, from which his anceſtors took the ſurnames of *Tiliander*, *Lindelius*, and *Linnæus*; and that this origin of ſurnames, taken from natural objects, is not uncommon in Sweden.

This eminent man, whoſe talents enabled him to reform the whole ſcience of natural hiſtory, accumulated, very early in life, ſome of the higheſt honours that await the moſt ſucceſsful proficients in medical ſcience; ſince we find that he was made profeſſor of phyſic and botany, in the univerſity of Upſal, at the age of 34; and ſix years afterwards, phyſician to his ſovereign the late king Adolphus; who in the year 1753 honoured him ſtill farther, by creating him knight of the order of the Polar Star. His honours did not terminate here: for in 1757 he was ennobled; and in 1776 the preſent king of Sweden accepted the reſignation of his office, and rewarded his declining years by doubling his penſion, and by a liberal donation of landed property ſettled on him and his family. Linnæus.

From Dr Pultney's General View of the Life and Writings of Linnæus.

It ſeems probable, that Linnæus's taſte for the ſtudy of nature was caught from the example of his father; who, as he has himſelf informed us, cultivated, as his firſt amuſement, a garden plentifully ſtored with plants. Young Linnæus ſoon became acquainted with theſe, as well as with the indigenous ones of his neighbourhood. Yet, from the ſtraitneſs of his father's income, our young naturaliſt was on the point of being deſtined to a mechanical employment: fortunately, however, this deſign was over-ruled. In 1717 he was ſent to ſchool at Wexſio; where, as his opportunities were enlarged, his progreſs in all his favourite purſuits was proportionably extended. At this early period he paid attention to other branches of natural hiſtory, particularly to the knowledge of inſects.

The firſt part of his academical education Linnæus received under profeſſor Stobæus, at Lund, in Scania, who favoured his inclinations to the ſtudy of natural hiſtory. After a reſidence of about a year, he removed in 1728 to Upſal. Here he ſoon contracted a cloſe friendſhip with Artedi, a native of the province of Angermania, who had already been four years a ſtudent in that univerſity, and, like himſelf, had a ſtrong bent to the ſtudy of natural hiſtory in general, but particularly to ichthyology. Soon after his reſidence at Upſal, our author was alſo happy enough to obtain the favour of ſeveral gentlemen of eſtabliſhed character in literature. He was in a particular manner encouraged in the purſuit of his ſtudies by the patronage of Dr Olaus Celſius, at that time profeſſor of divinity, and the reſtorer of natural hiſtory in Sweden; who, being ſtruck with the diligence of Linnæus in deſcribing the plants of the Upſal garden, and his extenſive knowledge of their names, not only patronized him in a general way, but admitted him to his houſe, his table, and his library. Under ſuch encouragement it is not ſtrange that our author made a rapid progreſs, both in his ſtudies and the eſteem of the profeſſors: in fact, we have a very ſtriking proof of his merit and attainments, inaſmuch as we find, that, after only two years reſidence, he was thought ſufficiently qualified to give lectures occaſionally from the botanic chair, in the room of profeſſor Rudbeck.

In the year 1731, the royal academy of ſciences at Upſal having for ſome time meditated the deſign of improving the natural hiſtory of Sweden, at the inſtance particularly of profeſſors Celſius and Rudbeck, deputed Linnæus to make the tour of Lapland, with the ſole view of exploring the natural hiſtory of that arctic region; to which undertaking, his reputation, already high as a naturaliſt, and the ſtrength of his conſtitution, equally recommended him. He left Upſal the 13th of May, and took his route to Gevalia or Gevels, the principal town of Geſtricia, 45 miles diſtant from Upſal. Hence he travelled through Helſingland into Medalpadia, where he made an excurſion, and aſcended a remarkable mountain, before he reached Hudwickſwald, the chief town of Helſingland. From hence he went through Angermanland to Hernoſand, a ſea-port on the Bothnic gulf, 70 miles diſtant from Hudwickſwald. When he had proceeded thus far, he found it proper to re-

Linnæus. tard his journey, as the ſpring was not ſufficiently advanced; and took this opportunity of viſiting thoſe remarkable caverns on the ſummit of mount Skula, though at the hazard of his life.

When Linnæus arrived at Uma, in Weſt Bothnia, about 96 miles from Hernoſand, he quitted the public road, and took his courſe through the woods weſtward, in order firſt to traverſe the moſt ſouthern parts of Lapland. Being now come to the country that was more particularly the object of his inquiries, equally a ſtranger to the language and to the manners of the people, and without any aſſociate, he committed himſelf to the hoſpitality of the inhabitants, and never failed to experience it fully. He ſpeaks in ſeveral places, with peculiar ſatisfaction, of the innocence and ſimplicity of their lives and their freedom from diſeaſes. In this excurſion he reached the mountains towards Norway; and, after encountering great hardſhips, returned into Weſt Bothnia, quite exhauſted with fatigue. Our traveller next viſited Pitha and Lula, upon the gulf of Bothnia; from which latter place he took again a weſtern route, by proceeding up the river of that name, and viſited the ruins of the temple of Jockmock in Lula Lapland or Lap Mark: thence he traverſed what is called the *Lapland Deſert*, deſtitute of all villages, cultivation, roads, or any conveniences; inhabited only by a few ſtraggling people, originally deſcended from the Finlanders, and who ſettled in this country in remote ages, being entirely a diſtinct people from the Laplanders. In this diſtrict he aſcended a noted mountain called *Wallevari*; in ſpeaking of which he has given us a pleaſant relation of his finding a ſingular and beautiful new plant (*Andromeda tetragona*) when travelling within the arctic circle, with the ſun in his view at midnight, in ſearch of a Lapland hut. From hence he croſſed the Lapland Alps into Finmark, and traverſed the ſhores of the north ſea as far as Sallero.

Theſe journeys from Lula and Pitha on the Bothnian gulf, to the north ſhore, were made on foot; and our traveller was attended by two Laplanders, one his interpreter, and the other his guide. He tells us, that the vigour and ſtrength of thoſe two men, both old, and ſufficiently loaded with his baggage, excited his admiration; ſince they appeared quite unhurt by their labour, while he himſelf, although young and robuſt, was frequently quite exhauſted. In this journey he was wont to ſleep under the boat with which they forded the rivers, as a defence againſt rain, and the gnats, which in the Lapland ſummer are not leſs teazing than in the torrid zones. In deſcending one of theſe rivers, he narrowly eſcaped periſhing by the overſetting of the boat, and loſt many of the natural productions which he had collected.

Linnæus thus ſpent the greater part of the ſummer in examining this arctic region, and thoſe mountains on which, four years afterwards, the French philoſophers ſecured immortal fame to Sir Iſaac Newton. At length, after having ſuffered incredible fatigues and hardſhips in climbing precipices, paſſing rivers in miſerable boats, ſuffering repeated viciſſitudes of extreme heat and cold, and not unfrequently hunger and thirſt, he returned to Tornoa in September. He did not take the ſame route from Tornoa as when he came into Lapland, having determined to viſit and examine the country on the eaſtern ſide of the Bothnian gulf: his firſt ſtage, therefore, was to Ula in Eaſt Bothnia; from thence to Old and New Carleby, 84 miles ſouth from Ula. He continued his route through Waſa, Chriſtianſtadt, and Biorneburgh, to Abo, a ſmall univerſity in Finland. Winter was now ſetting in apace; he therefore croſſed the gulf by the iſland of Aland, and arrived at Upſal in November, after having performed, and that moſtly on foot, a journey of ten degrees of latitude in extent, excluſively of thoſe deviations which ſuch a deſign rendered neceſſary. Linnæus.

In 1733 he viſited and examined the ſeveral mines in Sweden; and made himſelf ſo well acquainted with mineralogy and the docimaſtic art, that we find he was ſufficiently qualified to give lectures on thoſe ſubjects upon his return to the univerſity. The outlines of his ſyſtem on mineralogy appeared in the early editions of the *Syſtema Naturæ*; but he did not exemplify the whole until the year 1768.

In the year 1734 Linnæus was ſent by baron Reuterholm governor of Dalekarlia, with ſeveral other naturaliſts in that province, to inveſtigate the natural productions of that part of the Swediſh dominions; and it was in this journey that our author firſt laid the plan of an excellent inſtitution, which was afterwards executed, in a certain degree at leaſt, by himſelf, with the aſſiſtance of many of his pupils, and the reſult publiſhed under the title of *Pan Suecus*, in the ſecond volume of the *Amœnitates Academicæ*.

After the completion of this expedition, it appears that Linnæus reſided for a time at Fahlun, the principal town in Dalekarlia; where he tells us, that he taught mineralogy and the docimaſtic art, and practiſed phyſic; and where he was very hoſpitably treated by Dr More, the phyſician of the place. It alſo appears, that he contracted at this time an intimacy with one of that gentleman's daughters, whom he married about five years afterwards upon his ſettling as a phyſician at Stockholm.—In this journey he extended his travels quite acroſs the Dalekarlian Alps into Norway; but we have no particular account of his diſcoveries in that kingdom. In 1735 Linnæus travelled over many other parts of Sweden, ſome parts of Denmark and Germany, and fixed in Holland, where he chiefly reſided until his return to Stockholm, about the year 1739. In 1735, the year in which he took the degree of M. D. he publiſhed the firſt ſketch of his *Syſtema Naturæ*, in a very compendious way, and in the form of tables only, in 12 pages in folio. By this it appears, that he had at a very early period of his life (certainly before he was 24 years old) laid the baſis of that great ſtructure which he afterwards raiſed, not only to the increaſe of his own fame, but to that of natural ſcience.

In 1736, Linnæus came into England, and viſited Dr Dillenius, the late learned profeſſor at Oxford, whom he juſtly conſidered as one of the firſt botaniſts in Europe. He mentions with particular reſpect the civilities he received from him, and the privileges he gave him of inſpecting his own and the Sherardian collections of plants. It is needleſs to ſay, that he viſited Dr Martyn, Mr Rand, and Mr Miller, and that he was in a more ſingular manner indebted to the friendſhip of Dr Iſaac Lawſon. He alſo contracted an intimate friendſhip with Mr Peter Collinſon, which was reciprocally increaſed by a multitude

Linnæus. titude of good offices, and continued to the laſt without any diminution. Dr Boerhaave had furniſhed him with letters to our great naturaliſt Sir Hans Sloane; but, it is with regret that we muſt obſerve, they did not procure him the reception which the warmth of his recommendation ſeemed to claim.

One of the moſt agreeable circumſtances that happened to Linnæus during his reſidence in Holland, aroſe from the patronage of Mr Clifford, in whoſe houſe he lived a conſiderable part of his time, being now as it were the child of fortune:—*Exivi patriâ triginta ſex nummis aureis dives*—are his own words. With Mr Clifford, however, he enjoyed pleaſures and privileges ſcarcely at that time to be met with elſewhere in the world; that of a garden excellently ſtored with the fineſt exotics, and a library furniſhed with almoſt every botanic author of note. How happy he found himſelf in this ſituation, thoſe only who have felt the ſame kind of ardour can conceive. Whilſt in Holland, our author was recommended by Boerhaave to fill the place, then vacant, of phyſician to the Dutch ſettlement at Surinam; but he declined it on account of his having been educated in ſo oppoſite a climate.

Beſides being favoured with the particular patronage and friendſhip of Boerhaave and Mr Clifford, as is above mentioned, our author had alſo the pleaſure of being contemporary with, and of reckoning among the number of his friends, many other learned perſons who have ſince proved ornaments to their profeſſion, and whoſe merit has moſt deſervedly raiſed them to fame and honour. Among theſe we may properly mention Dr John Burman, profeſſor of botany at Amſterdam, whoſe name and family are well known in the republic of letters, and to whom our author dedicated his *Bibliotheca Botanica*, having been greatly aſſiſted in compiling that work by the free acceſs he had to that gentleman's excellent library; John Frederick Gronovius of Leyden, editor of Clayton's *Flora Virginica*, and who very early adopted Linnæus's ſyſtem; Baron Van Swieten, late phyſician to the Empreſs Queen; Iſaac Lawſon, before mentioned, afterwards one of the phyſicians to the Britiſh army, who died much regretted at Ooſterhout in the year 1747, and from whom Linnæus received ſingular and very important civilities; Kramer, ſince well known for an excellent treatiſe on the docimaſtic art; Van Royen, botanic profeſſor at Leyden; Lieberkun of Berlin, famous for his ſkill in microſcopical inſtruments and experiments. To theſe may be added alſo the names of Albinus and Gaubius, and of others, were it requiſite to ſhow that our author's talents had very early rendered him conſpicuous, and gained him the regard of all thoſe who cultivated and patroniſed any branch of medical ſcience, and to which, doubtleſs, the ſingular notice with which Boerhaave honoured him do not a little contribute.

Early in the year 1738, after Linnæus had left Mr Clifford, and, as it ſhould ſeem, when he reſided with Van Royen, he had a long and dangerous fit of ſickneſs; and upon his recovery went to Paris, where he was properly entertained by the Juſſieus, at that time the firſt botaniſts in France. The opportunity this gave him of inſpecting the Herbaria of Surian and Tournefort, and thoſe of the above-named gentlemen, afforded him great ſatisfaction. He had intended to have gone from thence into Germany, to viſit Ludwig and the celebrated Haller, with whom he was in cloſe correſpondence; but he was not able to complete this part of his intended route, and was obliged to return without this gratification. Linnæus.

Our author did not fail to avail himſelf of every advantage that acceſs to the ſeveral muſeums of this country afforded him, in every branch of natural hiſtory; and the number and importance of his publications, during his abſence from his native country, ſufficiently demonſtrate that fund of knowledge which he muſt have imbibed before, and no leſs teſtify his extraordinary application. Theſe were, *Syſtema Naturæ*, *Fundamenta Botanica*, *Bibliotheca Botanica*, and *Genera Plantarum*; the laſt of which is juſtly conſidered as the moſt valuable of all the works of this celebrated author. What immenſe application had been beſtowed upon it, the reader may eaſily conceive, on being informed, that before the publication of the firſt edition the author had examined the characters of 8000 flowers. The laſt book of Linnæus's compoſition, publiſhed during his ſtay in Holland, was the *Claſſes Plantarum*, which is a copious illuſtration of the ſecond part of the *Fundamenta*.

About the latter end of the year 1738, or the beginning of the next, our author ſettled as a phyſician at Stockholm; where he ſeems to have met with conſiderable oppoſition, and was oppreſſed with many difficulties; but all of theſe at length he overcame, and got into extenſive practice; and ſoon after his ſettlement, married the lady before ſpoken of. By the intereſt of Count Teſſin, who was afterwards his great patron, and even procured medals to be ſtruck in honour of him, he obtained the rank of phyſician to the fleet, and a ſtipend from the citizens for giving lectures in botany. And what at this time eſpecially was highly favourable to the advancement of his character and fame, by giving him an opportunity of diſplaying his abilities, was the eſtabliſhment of the Royal Academy of Sciences at Stockholm; of which Linnæus was conſtituted the firſt preſident, and to which eſtabliſhment the king granted ſeveral privileges, particularly that of free poſtage to all papers directed to the ſecretary. By the rules of the academy, the preſident held his place but three months. At the expiration of that term, Linnæus made his *Oratio de memorabilibus in Inſectis*, Oct. 3. 1739; in which he endeavours to excite an attention and inquiry into the knowledge of inſects, by diſplaying the many ſingular phenomena that occur in contemplating the nature of thoſe animals, and by pointing out, in a variety of inſtances, their uſefulneſs to mankind in particular, and to the economy of nature in general.

During all this time, however, Linnæus appears to have had his eye upon the botanic and medical chair at Upſal, at this time occupied by Rudbeck, who was far advanced in life. We learn indeed that he was ſo intent on purſuing and perfecting his great deſigns in the advancement of his favourite ſtudy of nature, that he had determined, if he failed in procuring the profeſſorſhip at Upſal, to accept the offer that had been made to him by Haller of filling the botanic chair at Gottingen. However, in courſe of time, he obtained his wiſh. In the year 1741, upon the reſignation

Linnæus. signation of Roberg, he was conſtituted joint profeſſor of phyſic and phyſician to the king with Roſen, who had been appointed in the preceding year on the death of Rudbeck. Theſe two colleagues agreed to divide the medical departments between them; and their choice was confirmed by the univerſity. Roſen took anatomy, phyſiology, pathology, and the therapeutic part; Linnæus, natural hiſtory, botany, materia medica, the dietetic part, and the diagnoſis morborum.

During the interval of his removal from Stockholm to Upſal in conſequence of this appointment, our profeſſor was deputed by the ſtates of the kingdom to make a tour to the iſlands of Oeland and Gothland in the Baltic, attended by ſix of the pupils, commiſſioned to make ſuch inquiries as might tend to improve agriculture and arts in the kingdom, to which the Swediſh nation had for ſome time paid a particular attention. The reſult of this journey was very ſucceſsful, and proved fully ſatisfactory to the ſtates, and was afterwards communicated to the public. On his return he entered upon the profeſſorſhip, and pronounced before the univerſity his oration *de Peregrinationum intra Patriam neceſſitate*, October 17. 1741; in which he forcibly diſplays the uſefulneſs of ſuch excurſions, by pointing out to the ſtudents that vaſt field of objects which their country held out to their cultivation, whether in geography, phyſics, mineralogy, botany, zoology, or economics, and by ſhowing the benefit that muſt accrue to themſelves and their country as rewards to their diligence. That animated ſpirit which runs through the whole of this compoſition, renders it one of the moſt pleaſing and inſtructive of all our author's productions.

Linnæus was now fixed in the ſituation that was the beſt adapted to his character, his taſte, and abilities; and which ſeems to have been the object of his ambition and centre of his hopes. Soon after his eſtabliſhment, he laboured to get the academical garden, which had been founded in 1657, put on a better footing, and very ſoon effected it; procuring alſo a houſe to be built for the reſidence of the profeſſor. The whole had been in ruin ever ſince the fire in 1702; and at the time Linnæus was appointed profeſſor of botany, the garden did not contain above fifty plants that were exotic. His correſpondence with the firſt botaniſts in Europe ſoon ſupplied him with great variety. He received Indian plants from Juſſieu of Paris, and from Van Royen of Leyden; European plants from Haller and Ludwig; American plants from the late Mr Collinſon, Mr Cateſby, and others; and variety of annuals from Dillenius: in ſhort, how much the garden owed to his diligence and care in a few years, may be ſeen by the catalogue publiſhed under the title of *Hortus Upſalienſis, exhibens Plantas exoticas horto Upſalienſis Academiæ a ſeſe (Linnæo) illatas ab anno* 1742, *in annum* 1748, *additis, differentiis ſynonymis, habitationibus, hoſpitiis, rariorumque deſcriptionibus, ingratiam ſtudioſæ juventutis*; Holm. 1748, 8vo, pp. 306. tab. 3. By this catalogue it appears, that the profeſſor had introduced 1100 ſpecies, excluſively of all the Swediſh plants and of varieties; which latter, in ordinary gardens, amount not unfrequently to one-third of the whole number. The preface contains a curious hiſtory of the climate at Upſal, and the progreſs of the ſeaſons throughout the whole year.

From the time that Linnæus and Roſen were appointed profeſſors at Upſal, it ſhould ſeem that the credit of that univerſity, as a ſchool of phyſic, had been increaſing: numbers of ſtudents reſorted thither from Germany, attracted by the character of theſe two able men; and in Sweden itſelf many young men were invited to the ſtudy of phyſic by the excellent manner in which it was taught, who otherwiſe would have engaged in different purſuits. Linnæus.

Whilſt Linnæus was meditating one of his capital performances, which had long been expected and greatly wiſhed for, he was interrupted by a tedious and painful fit of the gout, which left him in a very weak and diſpirited ſtate; and, according to the intelligence that his friends gave of him, nothing was thought to have contributed more to the reſtoration of his ſpirits than the ſeaſonable acquiſition, at this juncture, of a collection of rare and undeſcribed plants.

The fame which our author had now acquired by his *Syſtema Naturæ*, of which a ſixth edition, much enlarged, had been publiſhed at Stockholm in 1748 in 8vo, pp. 232. with eight tables explanatory of the claſſes and orders (and which was alſo republiſhed by Gronovius at Leyden), had brought, as it were, a conflux of every thing rare and valuable in every branch of nature, from all parts of the globe, into Sweden. The king and queen of Sweden had their ſeparate collections of rarities; the former at Ulrickſdahl; the latter, very rich in exotic inſects and ſhells, procured at a great expence, at the palace of Drottningholm; both of which our author was employed in arranging and deſcribing. Beſides theſe, the muſeum of the royal academy of Upſal had been augmented by a conſiderable donation from the king, whilſt hereditary prince, in 1746; by another from Count Gyllenborg the year before; by a third from M. Grill, an opulent citizen of Stockholm.

From this time we ſee the profeſſor in a more elevated rank and ſituation in life. His reputation had already procured him honours from almoſt all the royal ſocieties in Europe; and his own ſovereign, truly ſenſible of his merit, and greatly eſteeming his character and abilities, favoured him with a mark of his diſtinction and regard, by creating him a knight of the polar ſtar. It was no longer *laudatur et alget*. His emoluments kept pace with his fame and honours: his practice in his profeſſion became lucrative; and we find him ſoon after poſſeſſed of his country-houſe and gardens at Hammarby, about five miles from Upſal. He had moreover received one of the moſt flattering teſtimonies of the extent and magnitude of his fame that perhaps was ever ſhown to any literary character, the ſtate of the nation which conferred it, with all its circumſtances, duly conſidered. This was an invitation to Madrid from the king of Spain, there to preſide as a naturaliſt, with the offer of an annual penſion for life of 2000 piſtoles, letters of nobility, and the perfect free exerciſe of his own religion: But, after the moſt perfect acknowledgments of the ſingular honour done him, he returned for anſwer, 'that if he had any merits, they were due to his own country.'

In the year 1755, the Royal Academy of Sciences at Stockholm honoured our profeſſor with one of the firſt premiums, agreeably to the will of Count Sparre; who

Linnæus. who had decreed two gold medals, of ten ducats value each, to be annually given by the academy to the authors of ſuch papers, in the preceding year's Stockholm Acts, as ſhould be adjudged moſt uſeful in promoting agriculture particularly, and all branches of rural economy. This medal bore on one ſide the arms of the count, with this motto, *Superſtes in ſcientiis amor Frederici Sparre.* Linnæus obtained it in conſequence of a paper *De Plantis quæ Alpium Suecicarum indigenæ, magno rei æconomicæ et medicæ emolumento fieri poſſint;* and the ultimate intention was to recommend theſe plants, as adapted to culture in Lapland. This paper was inſerted in the Stockholm Acts for 1754, Vol. XV. Linnæus alſo obtained the *præmium centum aureorum*, propoſed by the Imperial academy of ſciences at Peterſburg, for the beſt paper written to eſtabliſh or diſprove, by new arguments, the doctrine of the ſexes of plants. It was, if poſſible, an additional glory to Linnæus to have merited this premium from the Peterſburgh academy; inaſmuch as a profeſſor of that ſociety, a few years before, had with more than common zeal, although with a futility like that of the other antagoniſts of our author, endeavoured to overturn the whole Linnæan ſyſtem of botany, by attempting to ſhow that the doctrine of the ſexes of plants had no foundation in nature, and was unſupported by facts and experiments.

It appears that Linnæus, upon the whole, enjoyed a good conſtitution; but that he was ſometimes ſeverely afflicted with a *hemicrania*, and was not exempted from the gout. About the cloſe of 1776, he was ſeized with an apoplexy, which left him paralytic; and at the beginning of the year 1777, he ſuffered another ſtroke, which very much impaired his mental powers. But the diſeaſe ſuppoſed to have been the more immediate cauſe of his death, was an ulceration of the urinary bladder; of which, after a tedious indiſpoſition, he died, January 11. 1778, in the 71ſt year of his age. —His principal other works, beſide thoſe already mentioned, are, The *Iter Oelandicum et Gotlandicum*, *Iter Scanicum*, *Flora Suecica*, *Fauna Suecica*, *Materia Medica*, *Philoſophia Botanica*, *Genera Morborum*, different papers in the *Acta Upſalienſia*, and the *Amœnitates Academicæ* The laſt of this great man's treatiſes was the *Mantiſſa Altera*, publiſhed in 1771; but before his death he had finiſhed the greateſt part of the *Mantiſſa Tertia*, afterwards completed and publiſhed by his ſon.

To the lovers of ſcience it will not appear ſtrange, nor will it be unpleaſant to hear, that uncommon reſpect was ſhown to the memory of this great man. We are told, that "on his death a general mourning took place at Upſal, and that his funeral proceſſion was attended by the whole univerſity, as well profeſſors as ſtudents, and the pall ſupported by ſixteen doctors of phyſic, all of whom had been his pupils." The king of Sweden, after the death of Linnæus, ordered a medal to be ſtruck, of which one ſide exhibits Linnæus's buſt and name, and the other Cybele, in a dejected attitude, holding in her left hand a key, and ſurrounded with animals and growing plants; with this legend, *Deam luctus angit amiſſi;* and beneath, *Poſt obitum Upſaliæ, die* x. *Jan.* M.DCC.LXXVIII. *Rege jubente.*—The ſame generous monarch not only honoured the Royal Academy of Sciences with his preſence when Linnæus's commemoration was held at Stockholm, but, as a ſtill higher tribute, in his ſpeech from the throne to the aſſembly of the ſtates, he lamented Sweden's loſs by his death. Nor was Linnæus honoured only in his own country. The late worthy profeſſor of botany at Edinburgh, Dr Hope, not only pronounced an eulogium in honour of him before his ſtudents at the opening of his lectures in the ſpring 1778, but alſo laid the foundation-ſtone of a monument (which he afterwards erected) to his memory, in the botanic garden there; which, while it perpetuates the name and merits of Linnæus, will do honour to the founder, and, it may be hoped, prove the means of raiſing an emulation favourable to that ſcience which this illuſtrious Swede ſo highly dignified and improved. Linnæus.

As to the private and perſonal character of this illuſtrious philoſopher: His ſtature was diminutive and puny; his head large, and its hinder part very high; his look was ardent, piercing, and apt to daunt the beholder; his ear not ſenſible to muſic; his temper quick, but eaſily appeaſed.

Nature had, in an eminent manner, been liberal in the endowments of his mind. He ſeems to have been poſſeſſed of a lively imagination, corrected however by a ſtrong judgment, and guided by the laws of ſyſtem. Add to theſe, the moſt retentive memory, an unremitting induſtry, and the greateſt perſeverance in all his purſuits; as is evident from that continued vigour with which he proſecuted the deſign, that he appears to have formed ſo early in life, of totally reforming and fabricating anew the whole ſcience of natural hiſtory; and this fabric he raiſed, and gave to it a degree of perfection unknown before; and had moreover the uncommon felicity of living to ſee his own ſtructure riſe above all others, notwithſtanding every diſencouragement its author at firſt laboured under, and the oppoſition it afterwards met with. Neither has any writer more cautiouſly avoided that common error of building his own fame on the ruin of another man's. He every where acknowledged the ſeveral merits of each author's ſyſtem; and no man appears to have been more ſenſible of the partial defects of his own. Thoſe anomalies which had principally been the objects of criticiſm, he well knew every artificial arrangement muſt abound with; and having laid it down as a firm maxim, that every ſyſtem muſt finally reſt on its intrinſic merit, he willingly commits his own to the judgment of poſterity. Perhaps there is no circumſtance of Linnæus's life which ſhows him in a more dignified light than his conduct towards his opponents. Diſavowing controverſy, and juſtly conſidering it as an unimportant and fruitleſs ſacrifice of time, he never replied to any, numerous as they were at one ſeaſon.

To all who ſee the aid this extraordinary man has brought to natural ſcience, his talents muſt appear in a very illuſtrious point of view; but more eſpecially to thoſe who, from ſimilarity of taſte, are qualified to ſee more diſtinctly the vaſt extent of his original deſign, the greatneſs of his labour, and the elaborate execution he has given to the whole. He had a happy command of the Latin tongue, which is alone the language of ſcience; and no man ever applied it more ſucceſsfully to his purpoſes, or gave to deſcription ſuch copiouſneſs, united with that preciſion and conciſeneſs which ſo eminently characteriſe his writings.

Linnæus, Linnet.

The ardour of Linnæus's inclinations to the ſtudy of nature, from his earlieſt years, and that uncommon application which he beſtowed upon it, gave him a moſt comprehenſive view both of its pleaſures and uſefulneſs, at the ſame time that it opened to him a wide field hitherto but little cultivated, eſpecially in his own country. Hence he was early led to regret, that the ſtudy of natural hiſtory, as a public inſtitution, had not made its way into the univerſities; in many of which, logical diſputations and metaphyſical theories had too long prevailed, to the excluſion of more uſeful ſcience. Availing himſelf therefore of the advantages which he derived from a large ſhare of eloquence, and an animated ſtyle, he never failed to diſplay, in a lively and convincing manner, the relation this ſtudy hath to the public good; to incite the great to countenance and protect it; to encourage and allure youth into its purſuits, by opening its manifold ſources of pleaſure to their view, and ſhowing them how greatly this agreeable employment would add, in a variety of inſtances, both to their comfort and emolument. His extenſive view of natural hiſtory, as connected with almoſt all the arts of life, did not allow him to confine theſe motives and incitements to thoſe only who were deſigned for the practice of phyſic. He alſo laboured to inſpire the great and opulent with a taſte for this ſtudy; and wiſhed particularly that ſuch as were devoted to an eccleſiaſtic life ſhould ſhare a portion of natural ſcience; not only as a means of ſweetening their rural ſituation, confined, as many are, perpetually to a country reſidence, but as what would almoſt inevitably lead, in a variety of inſtances, to diſcoveries which only ſuch ſituations could give riſe to, and which the learned in great cities could have no opportunities to make. Not to add, that the mutual communication and enlargement of this kind of knowledge among people of equal rank in a country ſituation, muſt prove one of the ſtrongeſt bonds of union and friendſhip, and contribute, in a much higher degree than the uſual periſhing amuſements of the age, to the pleaſures and advantage of ſociety.

Linnæus lived to enjoy the fruit of his own labour in an uncommon degree. Natural hiſtory raiſed itſelf in Sweden, under his culture, to a ſtate of perfection unknown elſewhere; and was from thence diſſeminated through all Europe. His pupils diſperſed themſelves all over the globe; and, with their maſter's fame, extended both ſcience and their own. More than this, he lived to ſee the ſovereigns of Europe eſtabliſh ſeveral public inſtitutions in favour of this ſtudy; and even profeſſorſhips eſtabliſhed in divers univerſities for the ſame purpoſe, which do honour to their founders and patrons, and which have excited a curioſity for the ſcience, and a ſenſe of its worth, that cannot fail to further its progreſs, and in time raiſe it to that rank which it is intitled to hold among the puſuits of mankind.

LINNET, in ornithology. See Fringilla.—It is remarkable of this bird, that when it builds in hedges, and when in furze-buſhes on heaths, in both which places the neſts are very common, they are made of very different materials. When they build in hedges, they uſe the ſlender filaments of the roots of trees, and the down of feathers and thiſtles; but when they build on heaths, they uſe moſs, principally for the outer part, finiſhing it within with ſuch things as the place will afford. Theſe birds will have young ones three or four times a-year, eſpecially if they are taken away before they are able to leave the neſts. Linſeed || Linternum.

When linnets are to be taught to whiſtle tunes, or to imitate the notes of any other bird, they muſt be taken from the old one when they are not above four day's old; for at this time they have no idea of the note of the old ones, and will be readily taught to modulate their voice like any thing that is moſt familiar to their ears, and within the compaſs of their throats. More care is required in feeding them when taken thus young, than when they are left in the neſt till nearly fledged; but they will be reared very well upon a food half bread and half rapeſeed boiled and bruiſed: this muſt be given them ſeveral times a-day. It muſt be made freſh every day, and given them ſufficiently moiſt, but not in the extreme. If it be in the leaſt ſour, it gripes and kills them; and if too ſtiff, it is as miſchievous by binding them up.——They muſt be hung up as ſoon as taken from the neſt, under the bird whoſe note they are intended to learn; or, if they are to be taught to whiſtle tunes, it muſt be done by giving them leſſons at the time of feeding; for they will profit more, while young, in a few days, than in a long time afterwards, and will take in the whole method of their notes before they are able to crack hard ſeeds. Some have attempted to learn them to ſpeak in the manner of the parrot or other birds; and they will arrive at ſome ſort of perfection in it, with great pains.

LINSEED, the ſeed of the plant linum.——Linſeed ſteeped and bruiſed in water gives it very ſoon a thick mucilaginous nature, and communicates much of its emollient virtue to it. See Linum.

LINT. See Flax, Linen, and Linum.

Lint, in ſurgery, is the ſcrapings of fine linen, uſed by ſurgeons in dreſſing wounds. It is made into various forms, which acquire different names according to the difference of their figures.——Lint made up in an oval or orbicular form is called a *pledgit*; if in a cylindrical form, or in ſhape of a date, or olive-ſtone, it is called a *doſſil*.

Theſe different forms of lint are required for many purpoſes; as, 1. To ſtop blood in freſh wounds, by filling them up with dry lint before the application of a bandage: though, if ſcraped lint be not at hand, a piece of fine linen may be torn into ſmall rags, and applied in the ſame manner. In very large hæmorrhages the lint or rags ſhould be firſt dipped in ſome ſtyptic liquor, as alcohol, or oil of turpentine; or ſprinkled with ſome ſtyptic powder. 2. To agglutinate or heal wounds; to which end lint is very ſerviceable, if ſpread with ſome digeſtive ointment, balſam, or vulnerary liquor. 3. In drying up wounds and ulcers, and forwarding the formation of a cicatrix. 4. In keeping the lips of wounds at a proper diſtance, that they may not haſtily unite before the bottom is well digeſted and healed. 5. They are highly neceſſary to preſerve wounds from the injuries of the air.——Surgeons of former ages formed compreſſes of ſponge, wool, feathers, or cotton; linen being ſcarce: but lint is far preferable to all theſe, and is at preſent univerſally uſed.

LINTERNUM, or Literum, (anc. geog.), a city of Campania, ſituated at the mouth of the Clanius, which is alſo called Liturnus, between Cumæ and

Lintſtock || Linum.

Vulturnum. It received a Roman colony at the ſame time with Puteoli and Vulturnum; was improved and enlarged by Auguſtus; afterwards forfeited its right of colonyſhip, and became a prefecture. Hither Scipio Africanus the Elder retired from the mean envy of his ungrateful countrymen; and here he died, and was buried: though this laſt is uncertain, he having a monument both here and at Rome. No veſtige of the place now remains.

LINTSTOCK, in military affairs, a wooden ſtaff about three feet long, having a ſharp point in one end and a ſort of fork or crotch on the other; the latter of which ſerves to contain a lighted match, and by the former the lintſtock is occaſionaliy ſtuck in the ground, or in the deck of a ſhip during an engagement. It is very frequently uſed in ſmall veſſels, where there is commonly one fixed between every two guns, by which the match is always kept dry, and ready for firing.

LINTZ, a very handſome town of Germany, and capital of Upper Auſtria, with two fortified caſtles; the one upon a hill, the other below it. Here is a hall in which the ſtates aſſemble, a bridge over the Danube, a manufacture of gunpowder, and ſeveral other articles. It was taken by the French in 1741, but the Auſtrians retook it in the following year. E. Long. 14. 33. N. Lat. 48. 16.

LINTZ, a town of Germany, in the circle of the Lower Rhine, and electorate of Cologne, ſubject to that elector. It is ſeated on the river Rhine, in E. Long. 7. 1. N. Lat. 50. 31.

LINUM, FLAX; a genus of the pentagynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 14th order, *Gruinales*. The calyx is pentaphyllous; the petals are five, the capſule is quinquevalved and decemlocular; and the ſeeds are ſolitary.

Species. 1. The uſitatiſſimum, or common annual flax, hath a taper fibrous root; upright, ſlender, unbranched ſtalks, two feet and a half high; garniſhed with narrow, ſpear-ſhaped, alternate grey-coloured leaves; and the ſtalks divided into footſtalks at top, terminated by ſmall blue crenated flowers in June and July; ſucceeded by large round capſules of ten cells, containing each one ſeed. 2. The perenne, or perennial Siberian flax, hath a fibrous perennial root, ſending up ſeveral upright, ſtrong, annual ſtalks, branching four or five feet high; garniſhed with ſmall narrow, ſpear-ſhaped, alternate leaves of a dark green colour; and terminated by umbellate cluſters of large blue flowers in June, ſucceeded by ſeeds in autumn. 3. The catharticum, or purging flax, with leaves oppoſite and lanceolate; the ſtem bifurcated, and the corollæ acute. This is a very ſmall plant, not above four or five inches high; found wild upon chalky hills and in dry pleaſure-grounds. There are 18 other ſpecies.

Culture. The firſt ſpecies is cultivated in the fields according to the directions given under the article FLAX. The ſecond ſort is raiſed from ſeed in a bed or border of common garden-earth, in ſhallow drills ſix inches aſunder; and when the plants are two or three inches high, thin them to the ſame diſtance; and in autumn plant them out where they are wanted.

Uſes. The firſt ſpecies may juſtly be looked upon as one of the moſt valuable of the whole vegetable kingdom; as from the bark of its ſtalks is manufactured the lint or flax for making all ſorts of linen-cloth; from the rags of the linen is made paper; and from the ſeeds is expreſſed the lintſeed oil ſo uſeful in painting and other trades. The ſeeds themſelves are eſteemed an excellent emollient and anodyne: they are uſed externally in cataplaſms, to aſſuage the pain of inflamed tumors: internally, a ſlight infuſion of linſeed, by way of tea, is recommended in coughs as an excellent pectoral, and of great ſervice in pleuriſies, nephritic complaints, and ſuppreſſions of urine. The virtue of the third ſpecies is expreſſed in its title: an infuſion in water or whey of a handful of the freſh leaves, or a dram of them in ſubſtance when dried, are ſaid to purge without inconvenience.

Linus || Liotard.

LINUS, in claſſical hiſtory, a native of Colchis, cotemporary with Orpheus, and one of the moſt ancient poets and muſicians of Greece. It is impoſſible, at this diſtance of time, to diſcover whether Linus was the diſciple of Orpheus, or Orpheus of Linus. The majority, however, ſeem to decide this queſtion in favour of Linus. According to arbhbiſhop Uſher, he flouriſhed about 1280 B. C. and he is mentioned by Euſebius among the poets who wrote before the time of Moſes. Diodorus Siculus tells us, from Dionyſius of Mitylene the hiſtorian, who was cotemporary with Cicero, that Linus was the firſt among the Greeks who invented verſes and muſic, as Cadmus firſt taught them the uſe of letters. The ſame writer likewiſe attributes to him an account of the exploits of the firſt Bacchus, and a treatiſe upon Greek mythology, written in Pelaſgian characters, which were alſo thoſe uſed by Orpheus, and by Pronapides the preceptor of Homer. Diodorus ſays that he added the ſtring *lichanos* to the Mercurian lyre; and aſcribes to him the invention of rhime and melody; which Suidas, who regards him as the moſt ancient of lyric poets, confirms. Mr Marpurg tell us, that Linus invented cat-gut ſtrings for the uſe of the lyre, which, before his time, was only ſtrung with thongs of leather, or with different threads of flax ſtrung together. He is ſaid by many writers to have had ſeveral diſciples of great renown; among whom were Hercules, Thamyris, and, according to ſome, Orpheus---Hercules, ſays Diodorus, in learning from Linus to play upon the lyre, being extremely dull and obſtinate, provoked his maſter to ſtrike him; which ſo enraged the young hero, that, inſtantly ſeizing the lyre of the muſician, he beat out his brains with his own inſtrument.

LION, in zoology. See FELIS.

LIONCELLES, in heraldry, a term uſed for ſeveral lions borne in the ſame coat of arms.

LIOTARD, called the *Turk*, an eminent painter, was born at Geneva in 1702, and by his father was deſigned for a merchant; but, by the perſuaſion of his friends, who obſerved the genius of the young man, he was permitted to give himſelf up to the art of painting. He went to Paris in 1725, and in 1738 accompanied the marquis de Puiſieux to Rome, who was going ambaſſador to Naples. At Rome he was taken notice of by the earls of Sandwich and Beſborough, then lord Duncannon, who engaged Liotard to go with them on a voyage to Conſtantinople. There he became acquainted with the late Lord Edgecumbe, and Sir Everard Fawkener, our ambaſſador, who perſuaded him to come to England, where he ſtaid two years. In his journey to the Levant he had adopted the eaſtern habit,

Lip || Lipari.

habit, and wore it here with a very long beard. It contributed much to the portraits of himself, and some thought to draw customers; but he was really a painter of uncommon merit. After his return to the continent, he married a young wife, and sacrificed his beard to Hymen. He came again to England in 1772, and brought a collection of pictures of different masters, which he sold by auction, and some pieces of glass painted by himself, with surprising effect of light and shade, but a mere curiosity, as it was necessary to darken the room before they could be seen to advantage; he affixed, too, as usual, extravagant prices to them. He staid here about two years, as in his former journey. He has engraved some Turkish portraits, one of the empress queen and the eldest arch-duchess in Turkish habits, and the heads of the emperor and empress. He painted admirably well in miniature; and finely in enamel, though he seldom practised it. But he is best known by his works in crayons. His likenesses were as exact as possible, and too like to please those who sat to him; thus he had great business the first year, and very little the second. Devoid of imagination, and one would think of memory, he could render nothing but what he saw before his eyes. Freckles, marks of the small-pox, every thing found its place; not so much from fidelity, as because he could not conceive the absence of any thing that appeared to him. Truth prevailed in all his works, grace in very few or none. Nor was there any ease in his out-line; but the stiffness of a bust in all his portraits. *Walpole.*

LIP, in anatomy. See there, n° 102.

Hare-Lip, a disorder in which the upper lip is in a manner slit or divided, so as to resemble the upper lip of a hare, whence the name. See SURGERY.

LIPARA (anc. geog.), the principal of the islands called *Æolia*, situated between Sicily and Italy, with a cognominal town, so powerful as to have a fleet, and the other islands in subjection to it. According to Diodorus Siculus, it was famous for excellent harbours and medicinal waters. He informs us also, that it suddenly emerged from the sea about the time of Hannibal's death. The name is Punic, according to Bochart: and given it, because, being a volcano, it shone in the night. It is now called *Lipari*, and gives name to nine others in its neighbourhood; viz. Stromboli, Pare, Rotto, Panaria, Saline, Volcano, Fenicusa, Alicor, and Ustica. These are called, in general, the *Lipari Islands*. Some of these are active volcanoes at present, though Lipari is not. It is about 15 miles in circumference; and abounds in corn, figs, and grapes; bitumen, sulphur, alum, and mineral waters.

LIPARI, an ancient and very strong town, and capital of an island of the same name in the Mediterranean, with a bishop's see. It was ruined by Barbarossa in 1544, who carried away all the inhabitants into slavery, and demolished the place; but it was rebuilt by Charles V. E. Long. 15. 30. N. Lat. 38. 35.

Lipari, properly, is the general name of a cluster of islands. These, according to Mr Houel, are principally ten in number, the rest being only uninhabitable rocks of narrow extent. The largest and the most populous of them, that above-mentioned, communicates its name to the rest. *Volcano* is a desert but habitable island, lying south from the large island of Lipari. *Salines*, which lies west-north-west from the same island; *Felicudi*, nearly in the same direction, but twenty miles farther distant; and *Alicudi*, ten miles south-west of Felicudi; are inhabited. *Pannari* is east of Lipari, the famous *Stromboli* north-east, and both of them are inhabited. The rest are in a desart state; such as *Baziluzzo*, which was formerly inhabited; *Attalo*, which might be inhabited; and *L'Exambianca*, on which some remains of ancient dwellings are still to be found. *L'Escanera* is nothing but a bare rock. Lipari.

The *Fermicoli*, a word signifying *ants*, are a chain of small black cliffs which run to the north-east of Lipari, till within a little way of Exambianca and Escanera, rising more or less above the water, according as the sea is more or less agitated.

Ancient authors are not agreed with respect to the number of the Lipari islands. Few of those by whom they are mentioned appear to have seen them: and in places such as these, where subterraneous fires burst open the earth and raise the ocean from its bed, terrible changes must sometimes take place. *Volcanella* and *Volcano* were once separated by a straight so as to form two islands. The lava and ashes have filled up the intervening strait; and they are now united into one island, and have by this change become much more habitable.

The castle of Lipari stands on a rock on the east quarter of the island. The way to it from the city leads up a gentle declivity. There are several roads to it. This castle makes a part of the city; and on the summit of the rock is the citadel, in which the governor and the garrison resides. The cathedral stands in the same situation. Here the ancients, in conformity to their usual practice, had built the temple of a tutelary god. This citadel commands the whole city; and it is accessible only at one place. Were an hostile force to make a descent on the island, the inhabitants might retreat hither, and be secure against all but the attacks of famine.

The ancient inhabitants had also fortified this place. Considerable portions of the ancient walls are still standing in different places, particularly towards the south: their structure is Grecian; and the stones are exceedingly large, and very well cut. The layers are three feet high, which shows them to have been raised in some very remote period. These remains are surrounded with modern buildings. The remains of walls, which are still to be seen here, have belonged not only to temples, but to all the different sorts of buildings which the ancients used to erect. The vaults, which are in a better state of preservation than any of the other parts of these monuments, are now converted to the purposes of a prison.

In the city of Lipari there are convents of monks of two different orders; but there are no convents for women, that is to say, no cloisters in which women are confined; those, however, whose heads and hearts move them to embrace a state of pious celibacy, are at liberty to engage in a monastic life, with the concurrence of their confessors. They put on the faced habit, and vow perpetual virginity, but continue to live with their father and mother, and mix in society like other women. The vow and the habit even enlarge

Lipari. their liberty. This cuſtom will, no doubt, M. Houel obſerves, appear very ſtrange to a Frenchwoman; but this was the way in which the virgins of the primitive church lived. The idea of ſhutting them up together did not occur till the fifth century. The life of theſe religious ladies is leſs gloomy than that which thoſe under the ſame vows lead in other countries. They wear cloaths of particular colours, according as they belong to this or that order. Their dreſs gives them a right to frequent the churches at any hours; and the voice of cenſure, which takes particular pleaſure in directing her attacks againſt pious ladies, goes ſo far as to aſſert, that ſome young women aſſume the habit with no other views but that they may enjoy greater freedom.

In this iſland oxen of a remarkably beautiful ſpecies are employed in ploughing the ground. The ancient plough is ſtill in uſe here. The mode of agriculture practiſed here is very expeditious. One man traces a furrow, and another follows to ſow in it grain and pulſe. The ploughman, in cutting the next furrow, covers up that in which the ſeed has been ſown: and thus the field is both ploughed and ſown at once. Nature ſeems to be here uncommonly vigorous and fertile. Vegetation is here more luxuriant, and animals gayer and more healthful, than almoſt any where elſe.

Near the city of Lipari, the traveller enters deep narrow roads, of a very ſingular appearance. The whole iſland is nothing but an aſſemblage of mountains, all of them conſiſting of aſhes or lava diſcharged from the depths of the volcano by which it was at firſt produced. The particles of this puzzolana, or aſhes, are not very hard; the action of the rain-water has accordingly cut out trenches among the mountains; and theſe trenches being perhaps leſs uneven than the reſt of the ſurface, have of conſequence been uſed as roads by the inhabitants, and have been rendered much deeper by being worn for ſo many ages by the feet of men and other animals. Theſe roads are more than five or ſix fathoms deep, and not more than ſeven or eight feet wide. They are very crooked, and have echoes in ſeveral places. You would think that you were walking through narrow ſtreets without doors or windows. Their depth and windings ſhelter the traveller from the ſun while he is paſſing hrough them; and he finds them deliciouſly cool.

The firſt volcanic eruption in the Lipari iſlands, mentioned in hiſtory, is that of which Callias takes notice of in his hiſtory of the wars in Sicily. Callias was contemporary with Agathocles. That eruption continued without interval for ſeveral days and nights; and threw out great ſtones, which fell at more than a mile's diſtance. The ſea boiled all around the iſland. The works of Callias are loſt, and we know not whether he deſcended to a detail of particulars concerning the ravages produced by this eruption. Under the conſulſhip of Æmilius Lepidus and L. Aurelius Oreſtes, 126 years before the Chriſtian era, theſe iſlands were affected with a dreadful earthquake. The burning of Ætna was the firſt cauſe of that. Around Lipari and the adjacent iſlands, the air was all on fire. Vegetation was withered; animals died; and fuſible bodies, ſuch as wax and reſin, became liquid. If the inhabitants of Lipari, from whom our author received theſe facts, and the writers who have handed down an account of them, have not exaggerated the truth, we Lipari. muſt believe that the ſea then boiled around the iſland; the earth became ſo hot as to burn the cables by which veſſels were fixed to the ſhore, and conſumed the planks, the oars, and even the ſmall boats.

Pliny, the naturaliſt *, ſpeaks of another ſimilar event which happened 30 or 40 years afterwards, in the time of the war of the allied ſtates of Italy againſt Rome. One of the Eolian iſlands, ſays he, was all on fire as well as the ſea; and that prodigy continued to appear, till the ſenate appeaſed, by a deputation, the wrath of the gods. From the time of that war, which happened 86 years before the birth of our Saviour, till the year 144 of our era, we have no account of any eruption of theſe volcanoes: and from that period again, till the year 1444, we hear of no exploſion from them, that is, for the ſpace of 1300 years. But, at that time, both Sicily and the Eolian iſles were agitated by dreadful ſhocks of earthquake: the volcano of theſe iſles poured forth ſtreams of lava with an awful violence, and emitted a volume of flame and ſmoke which roſe to an amazing height. After that it diſcharged enormous ſtones which fell at the diſtance of more than ſix miles.

* *Lib. ii. cap.* 106.

A century later, in the year 1550, the fury of this volcano was again renewed. The aſhes and ſtones diſcharged from the crater filled up the ſtrait between Volcano and Volcanello.

About two centuries after that, in the year 1739, there was a ſixth eruption. The burſtings of the volcanic fire were attended with a noiſe ſo dreadful, that it was heard as far as Melazzo in Sicily.

Father Leandro Alberti ſays, that on one of thoſe dreadful occaſions, the women of Lipari, after employing in vain all the ſaints, vowed to drink no more wine if the volcano ſhould ſpare them. Their giving up this ſmall gratification was doubtleſs of great ſervice; yet the eruptions ſtill continue, and have even become more frequent ſince that time. Only 36 years intervened between this eruption and that which happened in the year 1775. The whole iſland was then ſhaken; ſubterraneous thunder was heard; and conſiderable ſtreams of flame, with ſmoke, ſtones, and vitreous lava, iſſued from the crater. Lipari was covered over with aſhes; and part of theſe was conveyed by the winds all the way into Sicily. Five years after, however, in the month of April 1780, there iſſued a new exploſion from Volcano; the ſmoke was thick, the ſhocks conſtant, and the ſubterraneous noiſe very frequent. So great was the conſternation among the inhabitants of Lipari on this occaſion, that the commander Deodati Dolomieu, who viſited theſe iſlands not long after that event, informs us, that the inhabitants in general, but eſpecially the women, devoted themſelves as ſlaves to the ſervice of the bleſſed virgin; and wore on their arms, as tokens of their ſervitude, ſmall iron chains, which they ſtill continue to wear.

This act of piety, however, was not ſo efficacious as the deputation of the ſenate had been. For after that deputation, more than 200 years paſſed before the Eolian iſles were afflicted by any other eruption, at leaſt by any conſiderable one: Whereas, in three years after the ladies devoted themſelves in ſo ſubmiſſive a manner to the ſervice of the virgin, the iſles of Li-

Lipari. pari were agitated anew by that fatal earthquake which ravaged Calabria, and part of Sicily, on the 5th of February 1783.

The dry baths of St Calogero, in the iſland of Lipari, are ſtoves, where ſulphureous exhalations, known to be of a ſalutary nature, aſcend out of the earth by holes or ſpiracles. A range of apartments are built around the place where the exhalations ariſe. The heat is communicated through thoſe apartments in ſuch a way, that when entering at one end, you advance towards the other, the heat ſtill increaſes upon you till you gain the middle apartment, and again diminiſhes in the ſame manner as you proceed from the middle to the other end of the range of chambers. In conſequence of this diſpoſition of theſe apartments, the ſick perſon can make choice of that temperature which beſt ſuits the nature of his diſeaſe. There are a few miſerable huts and a ſmall chapel for the acommodation of the people who repair to theſe baths. The people of the place are ready to attend them. Phyſicians likewiſe follow their patients thither, when the diſeaſe is of ſuch a nature as to render their attendance requiſite, and the patient rich enough to afford them handſome fees: but there is no phyſician ſettled in the place. Beſides theſe dry baths, there are baths of hot water diſtinguiſhed by the name of *St Calogero's baths*. There are around them buildings ſufficient to lodge a conſiderable number of ſick people with their neceſſary attendants. At preſent, however, thoſe buildings are but in a bad condition.

The baths conſiſt of two halls; one ſquare, the other round. The former is antique; it has been built by the Romans; it is arched with a cupola, and 12 feet in diameter; it has been repaired: The other is likewiſe arched with a cupola both within and without. The water comes very hot into the firſt. It guſhes up from among pieces of lava, which compoſe a part of the mountain at the foot of which theſe baths are built. Thoſe ſtones remain in their natural ſtate. All that has been done is the raiſing of a ſquare building incloſing them. Within that building the ſick perſons either ſit down on the ſtones, or immerſe themſelves in the intervening cavities which are filled with water. They continue there for a certain time, and approach nearer to, or remain at a farther diſtance from, the ſpring, according as their phyſician directs. The place ſerves alſo as a ſtove. The hot vapours ariſing from the water communicate to the ſurrounding atmoſphere a conſiderable degree of heat. It is indeed not inferior to that of the hot baths of Termini, which owe their heat to a ſimilar cauſe. In theſe baths, therefore, a perſon can have the benefit either of bathing in the hot water, or of expoſing himſelf to the vapour, the heat of of which is more moderate. The bath before mentioned, under the appellation of *dry bath*, is alſo a ſtove; but the hot vapour with which it is filled iſſues directly from the volcano. The place of the bath is, however, at ſuch a diſtance from the volcanic focus, that the heat is not at all intolerable.

The mountain at the foot of which theſe baths are ſituated is round, and terminates at the ſummit in a rock of petrified aſhes, which are very hard and of a very fine grain. This petrification conſiſts of pretty regular ſtrata, and appears to have been greatly prior in its origin to the adjacent rocks; which conſiſt likewiſe of aſhes, but aſhes that have been depoſited at a much later period. From this rock there proceeds likewiſe a ſtream of hot water, by which ſome mills in the neighbourhood are moved. Lipari.

It cannot but appear ſurpriſing, that nature has placed nearly on the ſummit of a volcanic mountain ſprings which ſupply ſo conſiderable a quantity of water. To account for ſuch a phenomenon would be well worthy of ſome ingenious naturaliſt. Nor are theſe hot ſprings all; proceeding around the ſame hill, at about a mile's diſtance, we find a ſpring of cold water, which originates from the ſummit of the ſame rock; that on the north-weſt produces three hot ſprings. The cold water is very pleaſant to drink, and much uſed both by men and cattle.

Among theſe mountains there are many enormous looſe maſſes of lava, the appearance of which, M. Houel informs us, naturally leads the obſerver to take notice, that the lava of the volcano of Lipari is of a much greater diverſity of colours, and thoſe richer and more lively, than the lava of Veſuvius and Etna. The lava of Lipari is in ſome places, for ſeveral miles, of a beautiful red colour. It contains likewiſe in great abundance ſmall black cryſtalliſed ſcoriæ, as well as the ſmall white grains which are commonly found in lava.

Among the eminences which overlook the city of Lipari, there are ſome rocks of a ſpecies which is very rare in Europe. Thoſe are large maſſes of vitrified matter, which riſe ſix or eight feet above the ſurface of the ground, and appear to extend to a great depth under it. They exiſt, through that range of mountains, in enormous maſſes, mixed with lavas of every different colour, and always ſtanding detached and inſulated. Were they cut and followed under ground, they would probably be found to exiſt in immenſe quarries in the bowels of the earth. The glaſs of which they conſiſt might be employed with great advantage in manufactures. It is ready made, and might be eaſily purified. It is green, compact, and tranſparent.

The cultivation of the ground is the chief employment of the inhabitants of Lipari. The poſſeſſion of a few acres of land here gives a man great importance. Parents, when they ſettle their children, rather give them money than any part of their lands.

More than two-thirds of the iſland is planted with vines: three-fourths of the grapes which theſe produce are dried, and ſent moſtly to London under the name of *Paſſola*. There are different ſorts of paſſola: one of theſe, called the *black paſſolina*, is prepared from a particular kind of grape, of which the berries are uncommonly ſmall; and ſold to Marſeilles, Holland, and Trieſte. The vines are in ſmall arbours, which riſe only to the height of two feet and an half above the ground. Under thoſe arbours there grow beans, gourds, and other leguminous vegetables. In ſo hot a climate, the ſhade of the vines does not injure but protect the vegetables growing under it: they would otherwiſe be withered by the heat of the ſun.

The method of preparing paſſola and paſſolina is curious enough: They firſt make a lixivium of common aſhes; after boiling this, they paſs it through a cloth or a ſieve; they then put it again on the fire; and when

Lipari || Lippi.

when it is obſerved to boil hard, ſuddenly immerſe the grapes, but inſtantly bring them out again, and expoſe them to the ſun to dry on broad frames of cane. When ſufficiently dry, the raiſins are put into caſks and barrels to be ſold and exported. The number of caſks of different ſorts of raiſins annually exported from Lipari are eſtimated at 10,000.

This iſland likewiſe produces figs. There is ſome white malmſey and a little red wine exported from it.

About 60 or 80 years ſince, ſulphur was one of the articles with which the inhabitants of this iſland ſupplied foreign merchants. But that trade has been given up; from an idea which the Lipareſe entertain, that ſulphur infects the air ſo as to injure the fertility of the vines. The ſame prejudice prevails in Sicily; but it ſeems to be ill-founded.

There are courts of juſtice in Lipari, of the ſame powers and character with thoſe in the cities of Sicily. Cauſes of more than ordinary importance are carried to Palermo.

The iſland is entirely free from every kind of impoſition. The king receives nothing from it; becauſe Count Roger anciently beſtowed on its biſhop all his rights of royalty over Lipari. The biſhop there received annually from the inhabitants a tenth part of the products of their lands. They afterwards, to prevent fraud, eſtimated the value of that tithe for one year; and on the condition of their paying in future a ſum of money equal to what that year's tithe was valued at, he not only gave up his right to the tithe, but alſo ceded to them a conſiderable extent of land which belonged to him.

In the archiepiſcopal palace, and in the palace of the Baron de Monizzio, there are ſome noble pieces of painting by Sicilian painters:—A St Peter, a St Roſalia, Jeſus diſputing with the Jewiſh doctors, the adulterous woman, the incredulity of St Thomas.

LIPOTHYMIA, FAINTING, may ariſe from ſeveral cauſes; as too violent exerciſe, ſuppreſſion of the menſes or other accuſtomed evacuations, &c. See (the *Index* ſubjoined to) MEDICINE.

LIPPA, a town of Hungary, with a caſtle. It was taken by the Turks in 1552; by the Imperialiſts in 1688; and by the Turks again in 1691; who abandoned it in 1695, after having demoliſhed the fortifications. It is ſeated on a mountain, in E. Long. 21. 55. N. Lat. 36. 5.

LIPPE, the capital of a country of the ſame name in Germany, and the circle of Weſtphalia. It is ſeated on a river of the ſame name, and was formerly the reſidence of the principal branch of the houſe of Lippe. It is now in the poſſeſſion of the king of Pruſſia, and carries on a good trade in preparing timber for building veſſels on the Rhine, with which it has a communication by the river Lippe. The country round it is unwholeſome and marſhy. E. Long. 8. 12. N. Lat. 51. 43.

LIPPI (Lorenzo), a painter of hiſtory and portraits, was born in 1606, and learned the principles of painting from Matteo Roſelli. He had an exquiſite genius for muſic and poetry, as well as for painting; and in the latter, his proficiency was ſo great, that ſome of his compoſitions in the hiſtorical ſtyle were taken for thoſe of Roſelli. However, growing at laſt diſſatisfied with the manner of that maſter, he choſe the manner of Santi di Titi, who was excellent both in deſign and invention, and appeared to have more of ſimple nature and truth in his compoſitions than any other artiſt of that time. At Florence Lippi painted many grand deſigns for the chapels and convents, by which he enlarged his reputation; and at the court of Inſpruck, he painted a great number of portraits of the firſt nobility, which were deſervedly admired. Yet, altho' he was fond of imitating ſimple nature without any embelliſhments from invention, his works are held in the higheſt eſteem for the graceful airs of the heads, for the correctneſs of his outline, and for the elegant diſpoſition of the figures. He died in 1664.

Lipſius || Liquidambar.

LIPSIUS (Juſtus), a learned critic, was born at Iſch, a ſmall village near Bruſſels, in 1547. After having diſtinguiſhed himſelf in polite literature, he became ſecretary to cardinal de Granvellan at Rome, where the beſt libraries were open to him; and he ſpent much labour in collating the MSS. of ancient authors. He lived 13 years at Leyden; during which he compoſed and publiſhed what he eſteems his beſt works; but ſettled at Louvain, where he taught polite literature with great reputation. He was remarkable for unſteadineſs in religion, fluctuating often between the Proteſtants and Papiſts; but he became finally a bigotted catholic. He died at Louvain in 1606; and his works are collected in ſix volumes folio.

LIQUEFACTION, an operation by which a ſolid body is reduced into a liquid; or the action of fire or heat on fat and other fuſible bodies, which puts their parts into a mutual inteſtine motion.—The liquefaction of wax, &c. is performed by a moderate heat; that of ſal tartari, by the mere moiſture of the air. All ſalts liquefy; ſand, mixed with alkalies, becomes liqueſied by a reverberatory fire, in the making of glaſs. In ſpeaking of metals, inſtead of liquefaction, we ordinarily uſe the word *fuſion*.

LIQUID, a body which has the property of fluidity; and, beſides that, a peculiar quality of wetting other bodies immerged in it, ariſing from ſome configuration of its particles, which diſpoſes them to adhere to the ſurfaces of bodies contiguous to them. See FLUID.

LIQUID, among grammarians, is a name applied to certain conſonants oppoſed to mutes. Thus l, m, n, and r, are liquids.

LIQUIDAMBAR, SWEET-GUM-TREE, in botany: A genus of the polyandria order, belonging to the monœcia claſs of plants; and in the natural method ranking with thoſe of which the order is doubtful. The male calyx is common, and triphyllous; there is no corolla, but numerous filaments; the female calyces are collected into a ſpherical form, and tetraphyllous; there is no corolla, but ſeven ſtyles; and many bivalved and monoſpermous capſules collected into a ſphere. There are only two ſpecies, both deciduous, *viz.* 1. The ſtyraciflua, or the Virginia or maple-leaved liquidambar; a native of the rich moiſt parts of Virginia and Mexico. It will ſhoot in a regular manner to thirty or forty feet high, having its young twigs covered with a ſmooth, light-brown bark, while thoſe of the older are of a darker colour. The leaves are of a lucid green, and grow irregularly on the young branches, on long footſtalks: They reſemble thoſe of the common maple in figure; the lobes are all ſerrated; and from the baſe of the leaf a ſtrong mid-

Liquidambar.

rib runs to the extremity of each lobe that belongs to it. The flowers are of a kind of saffron colour: They are produced at the ends of the branches the beginning of April, and sometimes sooner; and are succeeded by large round brown fruit, which looks singular, but is thought by many to be no ornament to the tree. 2. The peregrinum, Canada liquidambar, or spleenwort-leaved gale, is a native of Canada and Pensylvania. The young branches of this species are slender, tough, and hardy. The leaves are oblong, of a deep green colour, hairy underneath, and have indentures on their edges alternately very deep. The flowers come out from the sides of the branches, like the former; and they are succeeded by small roundish fruit, which seldom ripens in England.

Propagation. This may be performed either by seeds or layers; but the first method is the best. 1. We receive the seeds from America in the spring. Against their arrival, a fine bed, in a warm well sheltered place, should be prepared. If the soil is not naturally good, and inclined to be sandy, it should be wholly taken out near a foot deep, and the vacancy filled up with earth taken up a year before from a fresh pasture with the sward, and all well rotted and mixed by being often turned, and afterwards mixed with a sixth part of drift or sea-sand. A dry day being made choice of, early in March, let the seeds be sown, and the finest of this compost riddled over them a quarter of an inch deep. When the hot weather in the spring comes on, the beds should be shaded, and waterings given often, but in very small quantities, only affording them a gentle, nay, a very small sprinkling, at a time. Millar says, the seeds of these plants never come up under two years. But, continues Hanbury, with this easy management, I hardly ever knew it longer than the end of May before the young plants made their appearance. The plants being come up, shading should still be afforded them in the parching summer, and a watering every other night; and this will promote their growth, and cause them to become stronger plants by the autumn. In the autumn, the beds should be hooped to be covered with mats in the severe frosts. These mats, however, should always be taken off in open weather; and this is all the management they will require during the first winter. The succeeding summer they will require no other trouble than weeding; though, if it should prove a dry one, they will find benefit from a little water now and then. By the autumn they will be grown strong enough to resist the cold of the following winter, without demanding the trouble of matting, if the situation is well sheltered; if not, it will be proper to have the hoops prepared, and the mats ready, against the black northern frosts, which would endanger at least their losing their tops. After this, nothing except weeding will be wanted; and in the spring following, that is, three years from their first appearance, they should be taken up (for they should not be removed before, unless some of the strongest plants be drawn out of the bed), and planted in the nursery a foot asunder, and two feet distant in the rows. Hoeing the weeds in the rows in the summer, and digging them in the winter, is all the trouble they will afterwards occasion until they are finally planted out. 2. These plants are easily increased by layers. The operation must be performed in the autumn, on the young summer's shoots; and the best way is by slitting them at a joint, as is practised for carnations. In a strong dry soil, they will be often two years or more before they strike root; though, in a fine light soil, they will be found to take freely enough. By this method good plants may be obtained; though it is not so eligible as the other, if we have the conveniency of procuring the seeds.

Liquor || Liriodendron.

Properties. The leaves emit their odoriferous particles in such plenty as to perfume the circumabient air; nay, the whole tree exsudes such a fragrant transparent resin, as to have given occasion to its being taken for the sweet storax †. These trees, therefore, are very proper to be planted singly in large opens, that they may amply display their fine pyramidal growth, or to be set in places near seats, pavilions, &c. The rosin was formerly of great use as a perfume, but is at present a stranger in the shops.

† See *Styrax*.

LIQUOR, a name for any fluid substance of the aqueous or spirituous kind.

The principal beverage amongst the Jews, as well as the Greeks and Romans, in their early state, was water, milk, and the juices of various plants infused therein. For a long time, under the commonwealth of Rome, wine was so scarce, that in their sacrifices to the gods the libations were made with milk only. Wine did not become common there till A.U.C. 609, when vines began to be planted.

Liquor of Flints. See CHEMISTRY, n° 1069.

Smoking Liquor of Libavius. See CHEMISTRY, n°810.

Mineral Anodyne Liquor of Hoffman. This is a compositi[on] of highly rectified spirit of wine, vitriolic ether, and [a] little of the dulcified oil of vitriol. It is made by mixing an ounce of the spirit of wine, which rises first in the distillation of ether, with as much of the liquor which is to be distilled, and afterwards by dissolving in the mixture which rises next, and which contains the ether, 12 drops of the oil which rises after the ether is passed. This has the same virtues with the ether, and is now generally disused, the pure ether being substituted in its place.

LIQUORICE. See GLYCYRRHIZA.

LIRIODENDRON, the TULIP-TREE, in botany: A genus of the polyginia order, belonging to the polyandria class of plants; and in the natural method ranking under the 52d order, *Coadunatæ*. The calyx is triphyllous; there are nine petals; and the seeds imbricated in such a manner as to form a cone.——There is but one species, viz. the *tulipifera*, a deciduous tree, native of most part of America. It rises with a large upright trunk, branching 40 or 50 feet high. The trunk, which often attains to a circumference of 30 feet, is covered with a grey bark. The branches, which are not very numerous, of the two-years-old wood, are smooth and brown; while the bark of the summer's shoots is smoother and shining, and of a bluish colour. They are very pithy. Their young wood is green, and when broken emits a strong scent. The leaves grow irregularly on the branches, on long footstalks. They are of a particular structure, being composed of three lobes, the middlemost of which is shortened in such a manner that it appears as if it had been cut off and hollowed at the middle: The two others are rounded off. They are about four or five inches long, and as many broad. They are of two colours; their upper surface is smooth, and of a stronger green than the lower. They fall off pretty early in autumn;

Liriodendron, Lis.

tumn; and the buds for the next year's ſhoots ſoon after begin to ſwell and become dilated, inſomuch that, by the end of December, thoſe at the ends of the branches will become near an inch long and half an inch broad. The outward laminæ of theſe leaf-buds are of an oval figure, have ſeveral longitudinal veins, and are of a bluiſh colour. The flowers are produced with us in July, at the ends of the branches: They ſomewhat reſemble the tulip, which occaſions its being called the Tulip-tree. The number of petals of which each is compoſed, like thoſe of the tulip, is ſix; and theſe are ſpotted with green, red, white, and yellow, thereby making a beautiful mixture. The flowers are ſucceeded by large cones, which never ripen in England.

Propagation. This is very eaſy, if the ſeeds are good; for by theſe, which we receive from abroad, they are to be propagated. No particular compoſt need be ſought for; neither is the trouble of pots, boxes, hotbeds, &c. required: They will grow exceedingly well in beds of common garden-mould, and the plants will be hardier and better than thoſe raiſed with more tenderneſs and care. Therefore, as ſoon as you receive the ſeeds, which is generally in February, and a few dry days have happened, ſo that the mould will work freely, ſow the ſeeds, covering them three quarters of an inch deep; and in doing of this, obſerve to lay them lengthwiſe, otherwiſe, by being very long, one part, perhaps that of the embryo plant, may be out of the ground ſoon, and the ſeed be loſt. This being done, let the beds be hooped; and as ſoon as the hot weather and drying winds come on in the ſpring, let them be covered from ten o'clock in the morning till ſun-ſet. If little rain happens, they muſt be duly watered every other day; and by the end of May the plants will come up. Shade and watering in the hotteſt ſummer muſt be afforded them, and they will afterwards give very little trouble. The next winter they will want no other care than, at the approach of it, ſticking ſome furze-buſhes round the bed, to break the keen edge of the black froſts; for it is found that the ſeedlings of this ſort are very hardy, and ſeldom ſuffer by any weather. After they have been two years in the ſeed-bed, they ſhould be taken up and planted in the nurſery, a foot aſunder, and two feet diſtant in the rows. After this, the uſual nurſery care of hoeing the weeds, and digging between the rows in the winter, will ſuffice till they are taken up for planting out.

Uſes. The tulip-tree, in thoſe parts of America where it grows common, affords excellent timber for many uſes: particularly, the trunk is frequently hollowed, and made into a canoe ſufficient to carry many people; and for this purpoſe no tree is thought more proper by the inhabitants of thoſe parts. With us, it may be ſtationed among trees of forty-feet growth.

LIS or Lys (John Vander), painter of hiſtory, landſcapes, and converſations, was born at Oldenburgh in 1570, but went to Haerlem to place himſelf as a diſciple under Henry Goltzius; and as he was endowed with great natural talents, he ſoon diſtinguiſhed himſelf in that ſchool, and imitated the manner of his maſter with great ſucceſs. He adhered to the ſame ſtyle till he went to Italy; where, having viſited Venice and Rome, he ſtudied the works of Titian, Tintoretto, Paolo Veroneſe, and Domenico Fetti, ſo effectually, that he improved his taſte and judgment, and altered his manner entirely. He ſoon received marks of public approbation; and his compoſitions became univerſally admired for their good expreſſion, for their lively and natural colouring, and the ſweetneſs and delicacy of his pencil: although it muſt be acknowledged, that he could never totally diveſt himſelf of the ideas and taſte peculiar to the Flemings. His ſubjects uſually were hiſtories taken from the ſacred writings, or the repreſentation of rural ſports, marriages, balls, and villagers dancing, dreſſed in Venetian habits; all which ſubjects he painted in a ſmall as well as a large ſize, with a number of figures, well deſigned, and touched with a great deal of delicacy. He was likewiſe accounted to paint naked figures admirably, with natural and elegant attitudes, and a very agreeable turn of the limbs. A capital picture of this maſter is, Adam and Eve lamenting the death of Abel; which is extremely admired, not only for the expreſſion, but alſo for the beauty of the landſcape: and in the church of St Nicholas at Venice is another of his paintings, repreſenting St Jerom in the deſart, with a pen in his hand, and his head turned to look at an angel, who is ſuppoſed to be ſounding the laſt trumpet. The colouring of this picture is rather too red; but it is deſigned in a fine ſtyle, and charmingly penciled. The paintings of this maſter are very rarely to be purchaſed. He died in 1629.

Lis (John Vander) of Breda, hiſtorical painter, was born at Breda about the year 1601, and became a diſciple of Cornelius Polemburg, whoſe manner he imitated with extraordinary exactneſs, in the tints of his colouring, his neatneſs of pencilling, and the choice of his ſubjects. There are ſome paintings of this maſter's hand, which, tho' they appear to have ſomewhat leſs freedom and lightneſs of touch, are nearly equal to thoſe of Polemburg, and are frequently taken to be his. At Rotterdam, in the poſſeſſion of Mr Biſſchop, there is a delicate painting repreſenting Diana in the Bath, attended by her nymphs; and his moſt capital performance, in England, is ſaid to be in the poſſeſſion of the Viſcount Middleton. The portrait of Vander Lis, painted by himſelf, is in the poſſeſſion of Horace Walpole, Eſq; which is deſcribed by that ingenious gentleman, as being worked up equal to the ſmoothneſs of enamel.

Lis. Liſbon.

LISBON, the capital of the kingdom of Portugal, ſituated in the province of Eſtremadura, on the banks of the river Tagus, in W. Long. 9. 25. N. Lat. 38. 25. It was anciently called *Oliſipo*, *Oliſippo*, and *Ulyſſipo*, which are ſuppoſed to be derived from the Phenician *Uliſubbo* or *Oliſippo* ſignifying in that tongue a *pleaſant bay*, ſuch as that on which this city ſtands. It firſt became conſiderable in the reign of king Emmanuel; from that king it hath been the capital of the kingdom, the reſidence of its monarchs, the ſeat of the chief tribunals, and offices of the metropolitan, a noble univerſity, and the receptacle of the richeſt merchandize of the Eaſt and Weſt Indies. Its air is excellent; being refreſhed by the delightful ſea-breezes, and thoſe of the Tagus. The city extends for about two miles along the Tagus; but its breadth is inconſiderable. Like old Rome, it ſtands on ſeven hills: but the ſtreets in general are narrow and dirty, and ſome of them are very ſteep; neither are they lighted at night. The churches, in general, are very fine; but the magnificence of the chapel-royal is amazing. Here is one of the fineſt harbours in the world; and there were a great number

not

Lisbon || Lisle.

not only of fine churches and convents here, but also of other public buildings, and particularly of royal palaces, and others belonging to the grandees; but the greateſt part of them, and of the city, were deſtroyed by a moſt dreadful earthquake, on Nov. 1. 1755, from which it will require a long time to recover. The inhabitants, before the earthquake, did not at moſt exceed 150,000. The government of it is lodged in a council, conſiſting of a preſident, ſix counſellors, and other inferior officers. The harbour has water enough for the largeſt ſhips, and room enough for 10,000 ſail without being crowded. For its ſecurity, there is a fort at the mouth of the river, on each ſide, and a bar that runs acroſs it, and is very dangerous to paſs without pilots. Higher up, at a place where the river is conſiderably contracted, there is a fort called *Torre de Belem*, or the *Tower of Belem*, under whoſe guns all ſhips muſt paſs in their way to the city; and on the other ſide are ſeveral more forts. Before the earthquake, moſt of the private houſes were old and unſightly, with lattice-windows; and the number of convents and colleges amounted to 50, namely, 32 for monks and 18 for nuns. The king's principal palace ſtands on the river, and is large and commodious. Of the hoſpitals, that called the *Great* is obliged to receive all perſons, of what degree, nation, or religion ſoever, without exception. At the village of Belem, near Liſbon, is a noble hoſpital for decayed gentlemen who have ſerved the king, and have not wherewithal to maintain themſelves. That called the *houſe of mercy* is alſo a noble charity. In the centre of the city, upon one of the higheſt hills, is the caſtle, which commands the whole, being large and ancient, and having always a garriſon of four regiments of foot. The cathedral is a vaſt edifice of the Gothic kind, but heavy and clumſy: it contains, however, great riches, and is finely adorned within. The ſquare called *Roſſio* is large, and ſurrounded with magnificent buildings. The whole city is under the eccleſiaſtical juriſdiction of the patriarch, who was appointed in the year 1717. Here is alſo an archbiſhop, who has, or at leaſt had before the erection of the patriarchate, a revenue of 40,000 cruſadoes, or 6000 l. The univerſity, which was removed for ſome time to Coimbra, but afterwards reſtored to its ancient ſeat, makes a conſiderable figure, though much inferior to that of Coimbra.

LISBURN, a town of Ireland, in the county of Antrim and province of Ulſter, 73 miles from Dublin. It was burnt down about 50 years ago; but is now rebuilt in a neat and handſome manner, and has a large linen manufactory. It is ſeated on the river Laggan, in W. Long. 6. 20. N. Lat. 54. 31. It gives title of earl to the family of Vaughan; and it returns two members to parliament, one half of the patronage of this borough being in the earl of Hertford. Fairs held 21ſt of July and 5th October.

LISIEUX, a conſiderable town of France, in Upper Normandy, with a biſhop's ſee. The churches and religious houſes, and the biſhop's palace, are all very handſome ſtructures. It is a trading place; and is ſeated at the confluence of the rivers Arbeck and Gaſſi, in E. Long. 0. 20. N. Lat. 49. 11.

LISLE, a large, rich, handſome, and ſtrong town of French Flanders, of which it is the capital, with a ſtrong caſtle, and a citadel built by Vauban, and ſaid to be the fineſt in Europe, as well as the beſt fortified. The large ſquare, and the public buildings, are very handſome; and they have manufactures of ſilks, cambrics, and camblets, as well as other ſtuffs, which have been brought to great perfection. It was taken by the duke of Marlborough, after three months ſiege and the loſs of many thouſands of men, in 1708; but reſtored to the French by the treaty of Utrecht, in conſideration of their demoliſhing the fortifications of Dunkirk. It is ſeated on the river Duele, 14 miles weſt of Tournay, 32 ſouth-weſt of Ghent, 37 north-weſt of Mons, and 130 north of Paris, E. Long. 3. 9. N. Lat. 50. 38.

Liſle || Liſmore.

LISLE (Claudius de), a learned hiſtoriographer, born at Vancouleurs, in 1644. He ſtudied among the Jeſuits at Pontamouſſon; took his degrees in law, and afterwards applied himſelf intirely to the ſtudy of hiſtory and geography; and to perfect himſelf in thoſe ſciences went to Paris, where the principal lords of the court became his ſcholars, and among the reſt the duke of Orleans, afterwards regent of the kingdom. He wrote, 1. An hiſtorical account of the kingdom of Siam. 2. A genealogical and hiſtorical Atlas. 3. An abridgement of univerſal hiſtory. He died at Paris in 1720.

LISLE (William de), ſon of the former, and the moſt learned geographer France has produced, was born at Paris in 1675. He became firſt geographer to the king, royal cenſor, and member of the academy of ſciences. He died in 1726. He publiſhed a great number of excellent maps, and wrote many pieces in the memoirs of the academy of ſciences.

LISLE (Sir John), a brave loyaliſt in the time of the civil wars, was the ſon of a bookſeller in London, and received his education in the Netherlands. He ſignalized himſelf upon many occaſions in the civil war, particularly in the laſt battle of Newbury; where, in the duſk of the evening, he led his men to the charge in his ſhirt, that his perſon might be more conſpicuous. The king, who was an eye-witneſs of his bravery, knighted him in the field of battle. In 1648, he roſe for his majeſty in Eſſex; and was one of the royaliſts who ſo obſtinately defended Colcheſter, and who died for the defence of it. This brave man having tenderly embraced the corps of Sir Charles Lucas, his departed friend, immediately preſented himſelf to the ſoldiers who ſtood ready for his execution. Thinking that they ſtood at too great a diſtance, he deſired them to come nearer: one of them ſaid, "I warrant you, Sir, we ſhall hit you." He replied with a ſmile, "Friends, I have been nearer you when you have miſſed me." He was executed Auguſt 28th 1648.

LISMORE, one of the Weſtern iſlands of Scotland, ſeated at the mouth of Loch Linnhe, a capacious lake in Argyleſhire, navigable for the largeſt ſhips to Fort William, which ſtands in the country called Lochaber. This iſland is above ſeven miles in length by one in breadth; and contains 1500 inhabitants. It abounds in limeſtone; from which, however, it has hitherto derived little advantage, owing to the want of good peat, the neglect of timber, and ſtill more the duty upon coals. Thus, with the advantages of navigation in every direction, and of a ſoil lying upon the richeſt manure, the people are indigent, and frequently obliged to import meal for their ſubſiſtence. Many of

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Lismore

them live a part of the year upon milk only. This island was formerly the residence of the bishops of Argyle.

Lismore, a borough, market, fair, and post town of Ireland, in the county of Waterford, and province of Munster, 100 miles from Dublin; N. Lat. 52. 5. W. Long. 7. 50. It was anciently called *Lessmore* or *Lios-more*, i. e. the great inclosure, or habitation; it is now a bishopric, and formerly had an university. St Carthagh or Mochuda, in the beginning of the seventh century founded an abbey and school in this place, which in a short time was much resorted to, not only by the natives, but also by the Britons and Saxons, during the middle ages. According to an ancient writer of the life of St Carthagh, Lismore was in general inhabited by monks, half of it being an asylum into which no woman dared enter; consisting intirely of cells and monasteries, the ruins of which, with seven churches, are yet visible. A castle was built here by king John. The site of Lismore was in early ages denominated *magh skia*, or the "chosen shield," being the situation of a dùn or fort, of the ancient chieftains of the Decies, one of whom granted it to St Carthagh on his expulsion from the abbey of Ratheny in Westmeath. On becoming an university, Math Sgiath obtained the name of *Dunsginne*, or the "fort of the Saxons," from the number of Saxons which resorted thereto: but soon after, it was called *Lios-mor* or *Lesmore*, and now *Lismore*; the bishopric of which was united to that of Waterford in 1363, being 730 years after its foundation. The public road to Cork was formerly through this place, and at that time it had a better face of business. St Carthagh, who retired to this place with some of his religious in 636, to avoid the fury of the then Irish monarch, tied his disciples to a most strict rule of life; they never were allowed the use of flesh, fish, or fowl; only the vegetables that the ground produced at the expence of their own labour. Father Daniel, in his *Histoire Monastique*, mentions one on the same foundation in France. The castle here, which, as we have formerly mentioned, was built by king John, was erected in 1195 on the ruins of the abbey of St Carthagh; it belonged to the duke of Devonshire, and gave birth to the great philosopher Robert Boyle. In 1189 it was demolished by the Irish, who took it by surprise. Being afterwards reedified, it was for many years an episcopal residence, till Myler Magrath, archbishop of Cashel, and bishop of this see, granted the manor of Lismore to that noted scholar and soldier Sir Walter Raleigh, in the reign of queen Elizabeth, at the yearly rent of L. 13 : 6 : 8; but that estate was lopped off with his head in the reign of king James I. After which it fell into the hands of Sir Richard Boyle, who purchased all Sir Walter's lands; he beautified the whole, and added many buildings to it, most of which were burned down in the Irish rebellion; at the breaking out of which, it was closely besieged by 5000 Irish, commanded by Sir Richard Beling, and was well defended by the young Lord Broghill, third son of the earl of Cork, who obliged them to raise the siege. The castle is boldly seated on the verge of a rocky hill, rising almost perpendicularly to a considerable height over the river Blackwater. The entrance is by an ancient and venerable avenue of trees. Over the gate are the venerable arms of the first earl of Cork. Opposite to the entrance is a modern portico of Bath stone, of the Doric order, designed by Inigo Jones. Most of the buildings have remained in ruins since the era of the rebellion; but the several offices that make up two sides of the square are kept in repair. At each angle is a tower, the chief remains of its former magnificence. In October 1785, the late duke of Rutland, then lord-lieutenant of Ireland, whilst on a tour in Munster, held a council in, and issued proclamations from this castle. The cathedral is still pretty well kept in repair. Here is a fine bridge over the river Blackwater, erected at a very great expence by the duke of Devonshire: this bridge is remarkable for the extent of the principal arch, the span of it being 102 feet. Below the town is a rich fishery for salmon, which is the greatest branch of trade here. Though this place is at present much reduced, yet Cambrensis informs us, that, not many years after the conquest, this was a very rich city, and held out some time against the English, who took it at last by storm, and gained rich plunder here, enough to load 16 sail of ships. It returns two members to parliament; patron, the duke of Devonshire, but the electors are called *potwollopers*. Fairs held on 25th May and September, and 12th November.

Lissa || List.

LISSA, an island in the Gulph of Venice, on the coast of Dalmatia, belonging to the Venetians, where they have a fishery of sardines and anchovies. It produces excellent wine, and is 70 miles west of Ragusa. E. Long. 17. 0. N. Lat. 43. 22.

Lissa, a town of Poland, in the palatinate of Posna, of which it is the capital. E. Long. 16. 0. N. Lat. 32. 15.

Lissa, a village of Silesia, 16 miles from Breslau, remarkable for a battle fought between the Prussians and the Austrians on the 15th of December 1757, when the latter were entirely defeated.

LISSUS, (anc. geog.), the last town of Illyricum, towards Macedonia, situated on the Drilo. It had a capacious port, the work of Dionysius the Tyrant, who led the colony thither, enlarged and walled it round, (Diodorus Siculus.) Now called *Alessio*, in Albania, on the Drino, near the Gulph of Venice. E. Long. 20. N. Lat. 42.

LIST, in commerce, the border of cloth or stuff; serving not only to show their quality, but to preserve them from being torn in the operations of fulling, dyeing, &c.—List is used on various occasions; but chiefly by gardeners for securing their wall-trees.

List, in architecture, a little square moulding, otherwise called a *fillet*, *listel*, &c. See Plate XXXVIII. fig. 1.

List, is also used, to signify the inclosed field or ground wherein the ancient knights held their justs and combats. It was so called, as being hemmed round with pales, barriers, or stakes, as with a list. Some of these were double, one for each cavalier; which kept them apart, so that they could not come nearer each other than a spear's length. See Just, Tournament, Duel, &c.

Civil List, in the British polity. The expences defrayed by the civil list are those that in any shape relate to civil government; as, the expences of the household; all salaries to officers of state, to the judges, and every one of the king's servants, the appointments to foreign

List. foreign ambaſſadors; the maintenance of the queen and royal family; the king's private expences, or privy-purſe; and other very numerous outgoings, as ſecret-ſervice money, penſions, and other bounties: which ſometimes have ſo far exceeded the revenues appointed for that purpoſe, that application has been made to parliament to diſcharge the debts contracted on the civil liſt; as particularly in 1724, when one million was granted for that purpoſe by the ſtatute 11 Geo. I. c. 17. and in 1769, when half a million was appropriated to the like uſes by the ſtatute 9 Geo. III. c. 34.

Blackſt. Comment. The civil liſt is indeed properly the whole of the king's revenue in his own diſtinct capacity; the reſt being rather the revenue of the public, or its creditors, though collected and diſtributed again in the name and by the officers of the crown: it now ſtanding in the ſame place, as the hereditary income did formerly; and as that has gradually diminiſhed, the parliamentary appointments have increaſed. The whole revenue of queen Elizabeth did not amount to more than 600,000l. a-year: that of king Char. I. was 800,000l. and the revenue voted for king Charles II. was 1,200,000l. though complaints were made (in the firſt years at leaſt) that it did not amount to ſo much. But it muſt be obſerved, that under theſe ſums were included all manner of public expences; among which Lord Clarendon, in his ſpeech to the parliament, computed, that the charge of the navy and land-forces amounted annually to 800,000l. which was ten times more than before the former troubles. The ſame revenue, ſubject to the ſame charges, was ſettled on king James II.: but by the increaſe of trade, and more frugal management, it amounted on an average to 1,500,000l. *per annum*, (beſides other additional cuſtoms granted by parliament, which produced an annual revenue of 400,000l. out of which his fleet and army were maintained at the yearly expence of 1,100,000 l. After the revolution, when the parliament took into its own hands the annual ſupport of the forces both maritime and military, a civil-liſt revenue was ſettled on the new king and queen, amounting, with the hereditary duties, to 700,000 l. *per annum*; and the ſame was continued to queen Anne and king George I. That of king Geo. II. was nominally augmented to 800,000*l. and in fact was conſiderably more: but that of his preſent majeſty is expreſsly limited to that ſum; tho' 100,000l. hath been ſince added. And upon the whole, it is doubtleſs much better for the crown, and alſo for the people, to have the revenue ſettled upon the modern footing rather than the ancient. For the crown, becauſe it is more certain, and collected with greater eaſe: for the people; becauſe they are now delivered from the feodal hardſhips, and other odious branches of the prerogative. And though complaints have ſometimes been made of the increaſe of the civil liſt, yet if we conſider the ſums that have been formerly granted, the limited extent under which it is now eſtabliſhed, the revenues and prerogatives given up in lieu of it by the crown, the numerous branches of the preſent royal family, and (above all) the diminution of the value of money compared with what it was worth in the laſt century, we muſt acknowledge theſe complaints to be void of any rational foundation; and that it is impoſſible to ſupport that dignity, which a king of Great Britain ſhould maintain, with an income in any degree leſs than what is now eſtabliſhed by parliament. See Revenue.

* See *Revenue.*

To List, or enliſt, Soldiers, to retain and enroll men as ſoldiers, either as volunteers, or by a kind of compulſion. Perſons liſted muſt be carried within four days, but not ſooner than 24 hours after, before the next juſtice of peace of any county, riding, city, or place, or chief magiſtrate of any city or town corporate (not being an officer in the army); and if before ſuch juſtice or magiſtrate they diſſent from ſuch enliſting, and return the enliſting-money, and alſo 20 ſhillings in lieu of all charges expended on them, they are to be diſcharged. But perſons refuſing or neglecting to return and pay ſuch money within 24 hours, ſhall be deemed as duly liſted as if they had aſſented thereto before the proper magiſtrate; and they ſhall, in that caſe, be obliged to take the oath, or, upon refuſal, they ſhall be confined by the officer who liſted them till they do take it. List || Litany.

LISTER (Dr Martin), an eminent Engliſh phyſician and naturaliſt, was born in 1638, and educated at Cambridge. He afterwards travelled into France; and at his return practiſed phyſic at York, and afterwards at London. In 1683, he was created doctor of phyſic, and became fellow of the college of phyſicians in London. In 1698, he attended the earl of Portland in his embaſſy from king William III. to the court of France; of which journey he publiſhed an account at his return, and was afterwards phyſician to queen Anne. He alſo publiſhed, 1. *Hiſtoria animalium Angliæ*, quarto. 2. *Conchyliorum ſynopſis*, folio. 3. *Cochlearum & limachum exercitatio anatomica*, 4 vols 8vo. 4. Many pieces in the Philoſophical Tranſactions; and other works.

LISTOWEL, a pariſh, alſo a poſt and fair town, of Ireland, in the county of Kerry and province of Munſter, 131 miles from Dublin, anciently *Lis Tuathal*, i. e. "the fort of Tuathal," who was exiled in the 1ſt century, but returned; and his life forms a brilliant era in Iriſh hiſtory. Near this are the ruins of a caſtle, pleaſantly ſituated on the river Feale: it was taken in November 1600, by Sir Charles Wilmot, being then held out for the Lord Kerry againſt Queen Elizabeth. Five miles beyond Liſtowel are the ruins of a church. The fairs are three in the year.

LITANA Silva (anc. geog.); a wood of the Boii, in the Gallia Togata, or Ciſpadana, where the Romans, under L. Poſthumius Albinus (whoſe head the Boii cut off, and carried in triumph into their moſt ſacred temple), had a great defeat, of twenty-five thouſand ſcarce ten eſcaping (Livy). Holſtenius conjectures, that this happened above the ſprings of the Scultenna, in a part of the Apennine, between Cerſinianum and Mutina. Now *Selva di Lugo*.

LITANY, a ſolemn form of ſupplication to God, in which the prieſt utters ſome things fit to be prayed for, and the people join in their interceſſion, ſaying, *we beſeech thee to hear us, good Lord*, &c. The word comes from the Greek λιτανεια, "ſupplication;" of λιτανευω, "I beſeech."

At firſt the uſe of litanies was not fixed to any ſtated time, but were only employed as exigencies required. They were obſerved, in imitation of the Niniveites, with ardent ſupplications and faſtings, to avert the threatening judgments of fire, earthquakes, inun-

Litchfield. dations, or hoſtile invaſions. About the year 400, litanies began to be uſed in proceſſions, the people walking barefoot, and repeating them with great devotion; and it is pretended, that by this means ſeveral countries were delivered from great calamities. The days on which theſe were uſed were called *rogation days:* theſe were appointed by the canons of different councils, till it was decreed by the council of Toledo, that they ſhould be uſed every month throughout the year; and thus by degrees they came to be uſed weekly on Wedneſdays and Fridays, the ancient ſtationary days for faſting. To theſe days the rubric of our church has added Sundays, as being the greateſt days for aſſembling at divine ſervice. Before the laſt review of the common prayer, the litany was a diſtinct ſervice by itſelf, and uſed ſome time after the morning prayer was over; at preſent it is made one office with the morning-ſervice, being ordered to be read after the third collect for grace, inſtead of the interceſſional prayers in the daily ſervice.

LITCHFIELD, a city of Staffordſhire, in England, 117 miles from London. It ſtands low, about three miles from the Trent; and its ancient name is ſaid to have been *Licidfield*, ſignifying, "a field of carcaſſes," from a great number of Chriſtians having, as it is pretended, ſuffered martyrdom here in the perſecution under Dioclefian. In the Saxons time, it was a biſhoprick for a ſhort ſpace; and is now, together with Coventry, a biſhoprick. It is divided into two parts by a rivulet and a kind of ſhallow lake, over which are two cauſeways with ſluices. It is a long ſtraggling place; but has ſome very handſome houſes, and well-paved clean ſtreets. That part on the ſouth ſide of the rivulet is called the *city*, and the other the *cloſe*. The *city* is much the largeſt, and contains ſeveral public ſtructures. It was incorporated by Edw. VI. with the name of bailiffs and burgeſſes; and is both a town and county, governed by 2 bailiffs choſen yearly out of 24 burgeſſes, a recorder, a ſheriff, a ſteward, and other officers. The city has power of life and death within their juriſdiction, a court of record, and a pie-powder-court. Here is a gaol both for debtors and felons, a free ſchool, and a pretty large well endowed hoſpital for a maſter and 12 brethren. The county of the city is 10 or 12 miles in compaſs, which the ſheriff rides yearly on the 8th of September, and then feaſts the corporation and neighbouring gentry. The *cloſe* is ſo called from its being incloſed with a wall and a deep dry ditch on all ſides except towards the city, where it is defended by a great lake or marſh formed by its brook. The cathedral, which ſtands in the cloſe, was originally built by Oſwius king of Northumberland about 300. It was rebuilt and enlarged by Offa king of Mercia in 766. In 1148 was rebuilt, and greatly enlarged in 1296. At the reformation, Coventry was divided from it. In the civil wars its ſpire was deſtroyed, and it converted to a ſtable. In 1776 a beautiful painted window, by the benefaction of Dr Adenbrook, has been ſet up at the weſtern end of the cathedral. In the civil wars it was ſeveral times taken and retaken, and thereby ſuffered much; but was ſo repaired after the reſtoration, at the expence of 20,000 l. that it was one of the faireſt and nobleſt ſtructures of the kind in England. It is walled in like a caſtle, and ſtands ſo high as to be ſeen 10 miles round. It is 450 feet long, of which the choir is 110, and the breadth in the broadeſt place 80. Its portico is hardly to be paralleled in England. There were till lately 26 ſtatues of the prophets, apoſtles, kings of Judah, and ſome kings of this land, in a row above it, as big as the life; and on the top, at each corner of the portico, is a ſtately ſpire, beſides a fine high ſteeple on the middle of the church. The choir is paved in great part with alabaſter and channel-coal, in imitation of black and white marble. In 1789 it went under a general repair, when the maſſive groined arch betwixt the weſt end of the church and the tranſcript, which had forced the ſide wall out of its perpendicular, was removed. The prebendaries ſtalls, which are thought to be the beſt in England, were moſt of them re-erected at the charge of the country gentlemen, whoſe names and arms are painted at the top of the ſtalls. The north door is extremely rich in ſculpture, but much injured by time. The body, which is ſupported by pillars formed of numbers of ſlender columns, has lately had its decayed leaden roof replaced by a neat ſlated covering. The choir merits attention on account of the elegant ſculpture about the windows, and the embattled gallery that runs beneath them; to which the altar-piece of Grecian architecture but ill correſponds; behind which is Mary's chapel, divided from it by a moſt elegant ſtone ſkreen of beautiful workmanſhip. Here ſtood St Chad's ſhrine, which coſt 2000 l. The charter-houſe is an octagon-room. In the ſame cloſe are the palaces of the biſhop and dean, and the prebendaries houſes in a court on the hill. Here are three other churches; one of which, St Michael's, has a church-yard of 6 or 7 acres. There was a caſtle here, long ſince deſtroyed: and ancient camps have been diſcovered in its environs. In the neighbourhood are frequent horſe-races. The markets there are on Tueſday and Friday, and ſix fairs in the year. By the late inland navigation, this place has communication with the rivers Merſey, Dee, Ribble, Ouſe, Trent, Darwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles in the counties of Lincoln, Nottingham, York, Lancaſter, Weſtmoreland, Cheſter, Warwick, Leiceſter, Oxford, Worceſter, &c. Litchfield ſends two members to parliament.

Litchfield ‖ Literati.

LITERARY, any thing belonging to LITERATURE.

LITERARY Property, or *Copy-Right*. See *COPY-Right*.

LITERATI (*letrados*, "lettered"), an epithet given to ſuch perſons among the Chineſe as are able to read and write their language. The literati alone are capable of being made mandarins.

LITERATI is alſo the name of a particular ſect, either in religion, philoſophy, or politics, conſiſting principally of the learned men of that country; among whom it is called *jukiao*, i. e. "learned."

It had its riſe in the year of Chriſt 1400, when the emperor, to awaken the native affection of the people for knowledge, which had been quite baniſhed by the preceding civil wars among them, and to ſtir up emulation among the mandarins, choſe out 42 of the ableſt among their doctors, to whom he gave a commiſſion to compoſe a body of doctrine agreeable to that of the ancients, which was then become the rule or ſtandard of the learned. The delegates applied themſelves to the

Literati ‖ Lithanthrax.

the buſineſs with very great attention; but ſome fancied them rather to have wreſted the doctrine of the ancients, to make it conſiſt with theirs, than to have built up theirs on the model of the ancients.

They ſpeak of the Deity, as if it were no more than mere nature or the natural power or virtue that produces, diſpoſes, and preſerves, the ſeveral parts of the univerſe. It is, ſay they, a pure, perfect principle, without beginning or end; it is the ſource of all things, the eſſence of every being, and that which determines it to be what it is. They make God the ſoul of the world: they ſay, he is diffuſed through all matter, and produces all the changes that happen there. In ſhort, it is not eaſy to determine, whether they reſolve God into nature, or lift up nature into God; for they aſcribe to it many of thoſe things which we attribute to God.

This doctrine, in lieu of the idolatry that prevailed before, introduced a refined kind of atheiſm. The work, being compoſed by ſo many perſons of learning and parts, and approved by the emperor himſelf, was received with infinite applauſe by all the people. Many were pleaſed with it, becauſe it ſeemed to ſubvert all religion; others approved it, becauſe the little religion that it left them could not give them much trouble. And thus was formed the ſect of the Literati; which conſiſts of the maintainers and adherents to this doctrine.

The court, the mandarins, and the perſons of fortune and quality, &c. are generally retainers to it; but a great part of the common people ſtill hold to their worſhip of idols.

Ths literati freely tolerate the Mahometans, becauſe they adore, with them, the king of heaven, and author of nature; but they bear a perfect averſion to all ſorts of idolaters among them: and it was once reſolved to extirpate them. But the diſorder this would have occaſioned in the empire prevented it: they now content themſelves with condemning them, in general, as hereſies; which they do ſolemnly every year at Pekin.

LITERATURE denotes learning or ſkill in letters.

LITERNUM. See LINTERNUM.

LITHANTHRAX, or *Pit-Coal*, is a black or brown, laminated, bituminous ſubſtance; not very eaſily inflammable, but, when once inflamed, burns longer and more intenſely than any other ſubſtance. Of this ſubſtance three kinds are diſtinguiſhed by authors. The reſiduum of the firſt after combuſtion is black; the reſiduum of the ſecond is ſpongy, and like pumice-ſtone; and the reſiduum of the third is whitiſh aſhes. Some foſſil coal, by long expoſure to air, falls into a greyiſh powder, from which alum may be extracted. Foſſil coal by diſtillation yields, 1. a phlegm or water; 2. a very acid liquor; 3. a thin oil like naphtha; 4. a thicker oil, reſembling petroleum, which falls to the bottom of the former, and which riſes with a violent fire; 5. an acid concrete ſalt; 6. an uninflammable earth remains in the retort. Theſe conſtituent parts of foſſil-coal are very ſimilar to thoſe of amber and other bitumens. For the exciting of intenſe heats, as of furnaces for ſmelting iron-ore, and for operations where the acid and oily vapours would be detrimental, as the drying of malt, foſſil-coals are previouſly charred, or reduced to *coaks*; that is, they are made to undergo an operation ſimilar to that by which charcoal is made. By this operation coals are deprived of their phlegm, their acid liquor, and the greateſt part of their fluid oil. Coaks therefore conſiſt of the two moſt fixed conſtituent parts, the heavy oil and the earth, together with the acid concrete ſalt, which tho' volatile is detained by the oil and earth.

Litharge ‖ Lithomantia.

LITHARGE, a preparation of lead, uſually in form of ſoft flakes, of a yellowiſh reddiſh colour. If calcined lead be urged with a haſty fire, it melts into the appearance of oil, and on cooling concretes into litharge. Greateſt part of the litharge met with in the ſhops is produced in the purification of ſilver from lead, and the refining of gold and ſilver by means of this metal: according to the degree of fire and other circumſtances, it proves of a pale or deep colour; the firſt has been commonly called *litharge of ſilver*, the other *litharge of gold*. See CHEMISTY-*Index*.

LITHGOW (William), a Scotſman, whoſe ſufferings by impriſonment and torture at Malaga, and whoſe travels, on foot, over Europe, Aſia, and Africa, ſeem to raiſe him almoſt to the rank of a martyr and a hero, publiſhed an account of his peregrinations and adventures. Though the author deals much in the marvellous, the horrid account of the ſtrange cruelties of which, he tells us, he was the ſubject, have, however, an air of truth. Soon after his arrival in England from Malaga, he was carried to Theobald's on a feather-bed, that King James might be an eye-witneſs of his *martyred anatomy*, by which he means his wretched body, mangled and reduced to a ſkeleton. The whole court crowded to ſee him; and his majeſty ordered him to be taken care of, and he was twice ſent to Bath at his expence. By the king's command, he applied to Gondamor, the Spaniſh ambaſſador, for the recovery of the money and other things of value which the governor of Malaga had taken from him, and for L. 1000 for his ſupport. He was promiſed a full reparation for the damage he had ſuſtained; but the perfidious miniſter never performed his promiſe. When he was upon the point of leaving England, Lithgow upbraided him with the breach of his word in the preſence-chamber, before ſeveral gentlemen of the court. This occaſioned their fighting upon the ſpot; and the ambaſſador, as the traveller oddly expreſſes it, had his fiſtula (with which diſorder he was afflicted) contrabanded with his fiſt. The unfortunate Lithgow, who was generally condemned for his ſpirited behaviour, was ſent to the Marſhalſea, where he continued a priſoner nine months. At the concluſion of the octavo edition of his *Travels* he informs us, that, in his three voyages, "his painful feet have traced over (beſides paſſages of ſeas and rivers) 36,000 and odd miles, which draweth near to twice the circumference of the whole earth." Here the marvellous ſeems to riſe to the incredible; and to ſet him, in point of veracity, below Coryat, whom it is nevertheleſs certain that he far outwalked. His deſcription of Ireland is whimſical and curious. This, together with the narrative of his ſufferings, is reprinted in Morgan's *Phœnix Britannicus*.

LITHIASIS, or STONE. See MEDICINE-*Index*.

LITHOMANTIA, in antiquity, a ſpecies of divination performed with ſtones. Sometimes the ſtone called *ſiderites* was uſed: this they waſhed in ſpring-water.

Lithontripticus || Lithoſtroton.

water in the night by candle-light; the perſon that conſulted it was to be purified from all manner of pollution, and to have his face covered: this done, he repeated divine prayers, and placed certain characters in an appointed order; and then the ſtone moved of itſelf, and in a ſoft gentle murmur, or (as ſome ſay) in a voice like that of a child, returned an anſwer. By a ſtone of this nature, Helena is reported to have foretold the deſtruction of Troy.

LITHONTRIPTICUS (from λιθος "a ſtone," and θρυπτω "to break"); an epithet for medicines that are ſuppoſed to break the ſtone in the bladder. Though the different ſtones that are generated in the human bladder require different ſolvents when out of the body; and though art hath not yet afforded a medicine which, when injected into the bladder, will, without injury thereto, diſſolve the ſtone therein lodged; it cannot thence be concluded, that there are no lithontriptic medicines. It may be here obſerved, that one ſolvent affects one ſubject, but hath no effect on another; ſo a ſolvent may yet be met with that will deſtroy the ſtone, and not hurt the human body. The water into which the boiled white of egg diſſolves will liquefy myrrh, but may be put into the human eye without cauſing any uneaſineſs.

Soap ley taken at firſt in ſmall doſes in broth that is freed from all its fat, ſucceeds in moſt caſes which require an alkaline ſolvent. The patient may begin with 20 drops, and gradually increaſe the doſe as he is able; and by repeating it three times a-day for ſix, eight, or twelve months, the wiſhed for effects often follow.

LITHOPHYTA, the name of Linnæus's third order of vermes. See ZOOLOGY.

LITHOSPERMUM, GROMWELL: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 41ſt order, *Aſperifoliæ*. The corolla is funnel-ſhaped, with the throat perforated and naked; the calyx quinquepartite. There are ſeveral ſpecies; but the only remarkable ones are the officinale or common gromwell, and the arvenſe or baſtard alkanet. Both theſe are natives of Britain; the former growing in dry gravelly ſoil, the latter in corn-fields. The ſeeds of the firſt are reputed to be of ſervice in calculous caſes. Dr Grew ſays, that they have ſo much earth in their compoſition, that they effervеſce with acids; but if this is the caſe, it muſt be attributed rather to an alkaline than an earthy quality.

LITHOSTROTION, in natural hiſtory, the name of a ſpecies of foſſil coral, compoſed of a great number of long and ſlender columns, ſometimes round, ſometimes angular, jointed nicely to one another, and of a ſtarry or radiated ſurface at their tops. Theſe are found in conſiderable quantities in the northern and weſtern parts of this kingdom, ſometimes in ſingle, ſometimes in complex ſpecimens. See Plate CC.

LITHOSTROTON, among the Romans, was a pavement of Moſaic work, conſiſting of ſmall pieces of cut marble of different kinds and colours. The *lithoſtrota* began to be uſed in the time of Sylla, who made one at Prænеſte in the temple of Fortune. At laſt they were uſed in private houſes; and were brought to ſuch perfection, that they exhibited moſt lively repreſentations of nature, with all the exactneſs of the fineſt painting.

Lithotomy || Litmus.

LITHOTOMY, in ſurgery, the operation of cutting for the ſtone. See SURGERY.

LITHUANIA, an extenſive province of Poland. By the natives it is called *Letwa*, and has Great Poland and Ruſſia on the weſt; part of Muſcovy on the eaſt; Livonia, the Baltic Sea, and part of Muſcovy, on the north; Red Ruſſia, Volhinia, and Padolia, on the ſouth; and the Ukraine on the ſouth-eaſt. Its length is ſaid to be about 360, and its breadth 340 miles; but it is much indented both ways. Lithuania was anciently over-run with wood; and there are ſtill many foreſts in it, which yield a great deal of honey, wax, pitch, tar, and timber; and abound with wild boars, buffaloes, elks, wild horſes, wild aſſes, uri, and woodcocks. The lakes are alſo numerous, and well-ſtored with fiſh: but the air, by reaſon of theſe foreſts and lakes, is ſaid to be thick and foggy. The country produces a great deal of buck-wheat and other corn, the paſtures are luxuriant, and the flocks and herds numerous: ſo that, notwithſtanding agriculture is much neglected, proviſions are exceeding cheap, but money ſo ſcarce, that 10 *per cent.* is the common intereſt. The principal nobility have large eſtates, and live in great pomp and ſplendor, generally retaining ſome hundreds of thoſe that are poor, in quality of domeſtics. The eſtabliſhed religion is Popery; but Lutherans, Calviniſts, Jews, Turks, Greeks, and Socinians, are very numerous. Lithuania was governed by its own dukes till it was united to Poland, towards the end of the 14th century, when the great Duke Jagello married Hedwig, the dowager of Louis king of Poland and Hungary. It had even dukes after that, but they were ſubordinate to the king; and at this day, tho' one diet ſerves for both countries, yet each has its peculiar laws, cuſtoms, dialect, and privileges. In a diet held at Lublin in 1569, it was more cloſely united to Poland than it had been before; and it was enacted, that both countries, for the future, ſhould form but one ſtate under the ſame prince. As to their courts of juſtice, the tenth part of what is adjudged in all real actions goes always to the judge's box, and is immediately paid in court; and in perſonal actions he claims half the damages given. A nobleman is only fined for murder, as in Poland. The common people here, excepting the burghers in the royal towns, and the Germans, are ſlaves; and, in many places, the ignorant vulgar ſtill retain ſome remains of idolatry. The poor people have only Mondays to themſelves; and if their lords have occaſion for them even on that day, the peaſant muſt work for himſelf on Sunday. If any of them is condemned to death by his lord, he muſt execute himſelf, or ſuffer greater cruelty. The dialect is a language of the Sclavonic; and they ſpeak here, as in Poland, a barbarous kind of Latin. Lithuania is divided into nine palatinates. Another diviſion is into Lithuania properly ſo called, and Lithuanian Ruſſia. Some alſo comprehend under it Samogitia and Courland, which is a fief of Poland.

LITMUS, or LACMUS, in the arts, is a blue pigment, formed from *archil*. It is brought from Holland at a cheap rate; but may be prepared by adding quick

Litter || Littleton.

quick lime and putrified urine, or ſpirit of urine diſtilled from lime, to the archil previouſly bruiſed by grinding. The mixture having cooled, and the fluid ſuffered to evaporate, becomes a maſs of the conſiſtence of a paſte, which is laid on boards to dry in ſquare lumps. It is only uſed in miniature paintings, and cannot be well depended on, becauſe the leaſt approach of acid changes it inſtantly from blue to red. The beſt litmus is very apt to change and fly.

LITTER (*lectica*), a kind of vehicle borne upon ſhafts; anciently eſteemed the moſt eaſy and genteel way of carriage. Du-Cange derives the word from the barbarous Latin *lectaria* "ſtraw or bedding for beaſts." Other will rather have it come from *lectus* "bed;" there being ordinarily a quilt and a pillow to a litter in the ſame manner as to a bed.

Pliny calls the litter the *traveller's chamber*: it was much in uſe among the Romans, among whom it was borne by ſlaves kept for that purpoſe; as it ſtill continues to be in the eaſt, where it is called a *palanquin*.—The Roman lectica, made to be borne by four men, was called *tetraphorum*; that borne by ſix *hexaphorum*; and that borne by eight *octaphorum*.

The invention of litters, according to Cicero, was owing to the kings of Bithynia: in the time of Tiberius they were become very frequent at Rome, as appears from Seneca; and even ſlaves themſelves were borne in them, though never by more than two perſons, whereas men of quality had ſix or eight.

LITTER alſo denotes a parcel of dry old ſtraw put on the floor of a horſe's ſtall for him to lie down and reſt upon. When a horſe comes tired into a ſtable, freſh litter has the virtue of making him ſtale immediately. This is known to be a very great advantage to a horſe in a tired ſtate; and when the litter is old and dirty, it never has any ſuch effect upon him. If the owners knew how refreſhing it is for a horſe to diſcharge his urine on his return from labour, they would be more careful of giving them all means and occaſions of it than they are. This ſtaling after fatigue prevents thoſe obſtructions in the neck of the bladder or urinary paſſages which horſes are too ſubject to. The bladder being often inflamed by the long retention of the heated urine in it, the creature is thus in danger of periſhing.

LITTLE (William), an ancient Engliſh hiſtorian, known alſo by the name of *Gulielmus Neubrigenſis*, was born at Bridlington in the county of York, in the year 1136; and educated in the abbey of Newborough in the ſame county, where he became a monk. In his advanced years, he compoſed a hiſtory of England, in five books, from the Norman conqueſt to A. D. 1197; which, for veracity, regularity of diſpoſition, and purity of language, is one of the moſt valuable productions of this period.

LITTLETON (Sir Thomas), judge of the common-pleas, was the eldeſt ſon of Thomas Weſtcote, eſq; of the county of Devon, by Elizabeth, ſole heireſs of Thomas Littleton of Frankley in Worceſterſhire, at whoſe requeſt he took the name and arms of that family. He was educated at one of our univerſities, probably at Cambridge. Thence he removed to the Inner Temple, where he became one of the readers; and was afterwards, by Henry VI. made ſteward or judge of the court of the palace, or marſhalſea of the king's houſehold. In 1455, the thirty-third of that reign, he was appointed king's ſerjeant, and rode the northern circuit as judge of aſſize. In 1462, the ſecond of Edward IV. he obtained a pardon from the crown; and, in 1466, was appointed one of the judges of the common-pleas, and rode the Northamptonſhire circuit. In the year 1474 he was, with many of the firſt nobility, created knight of the Bath. He died in 1481; and was buried in the cathedral church of Worceſter, where a marble tomb, with his ſtatue upon it, was erected to his memory. As to his character as a lawyer, it is ſufficient to inform the reader, that he was the author of the Treatiſe upon Tenures, on which Sir Edward Coke wrote a comment, well known by the title of *Coke upon Littleton*.

Littleton, Liturgy.

LITTLETON (Adam), deſcended from an ancient family in Shropſhire, was born in 1627, educated at Weſtminſter-ſchool, and went to Oxford a ſtudent of Chriſt-church, whence he was ejected by the parliament viſitors in 1648. Soon after, he became uſher of Weſtminſter-ſchool, and in 1658 was made ſecond maſter of Weſtminſter-ſchool. After the reſtoration he taught a ſchool at Chelſea in Middleſex, of which church he was admitted rector in the year 1664. In 1670 he accumulated the degrees in divinity, being then chaplain in ordinary to his majeſty. In 1674, he became prebendary of Weſtminſter, of which church he was afterwards ſub-dean. Beſide the well-known *Latin* and *Engliſh* Dictionary, he publiſhed ſeveral other works. He died in 1694, and was interred at Chelſea. He was an univerſal ſcholar; and extremely charitable, humane, and eaſy of acceſs.

LITURGY, denotes all the ceremonies in general belonging to divine ſervice.

The word comes from the Greek λειτουργια "ſervice, public miniſtry;" formed of λειτος "public," and εργον "work."

In a more reſtrained ſignification, liturgy is uſed among the Romaniſts to ſignify the *maſs*; and among us the *common-prayer*.

All who have written on liturgies agree, that in the primitive days divine ſervice was exceedingly ſimple, only clogged with a very few ceremonies, and conſiſting of but a ſmall number of prayers; but, by degrees, they increaſed the number of external ceremonies, and added new prayers, to make the office look more awful and venerable to the people. At length things were carried to ſuch a pitch, that a regulation became neceſſary; and it was found proper to put the ſervice, and the manner of performing it, into writing; and this was what they called a *liturgy*.

Liturgies have been different at different times, and in different countries. We have the liturgy of St Chryſoſtom, that of St Peter, of St James, the liturgy of St Baſil, the Armenian liturgy, the liturgy of the Maronites, of the Cophtæ, the Roman liturgy, the Gallican liturgy, the Engliſh liturgy, the Ambroſian liturgy, the Spaniſh and African liturgies, &c.

In the more early ages of the church, every biſhop had a power to form a liturgy for his own dioceſe; and if he kept to the analogy of faith and doctrine, all circumſtances were left to his own diſcretion. Afterwards the practice was for the whole province to follow the metropolitan church, which alſo became the general rule of the church: and this Lindwood acknowledges.

Liturgy || Livadia.

ledges to be the common law of the church; intimating, that the uſe of ſeveral ſervices in the ſame province, which was the caſe in England, was not to be warranted but by long cuſtom. The liturgy of the church of England was compoſed in the year 1547, and eſtabliſhed in the ſecond year of King Edward VI. ſtat. 2. and 3 Ed. VI. cap. 1.

In the fifth year of this king it was reviewed; becauſe ſome things were contained in that liturgy which ſhowed a compliance with the ſuperſtition of thoſe times, and ſome exceptions were taken againſt it by ſome learned men at home, and by Calvin abroad. Some alterations were made in it, which conſiſted in adding the general confeſſion and abſolution, and the communion to begin with the ten commandments. The uſe of oil in confirmation and extreme unction were left out, and alſo prayers for ſouls departed, and what tended to a belief of Chriſt's real preſence in the euchariſt. This liturgy, ſo reformed, was eſtabliſhed by the act of 5 and 6 Ed. VI. cap. 1. However, it was aboliſhed by Queen Mary, who enacted, that the ſervice ſhould ſtand as it was moſt commonly uſed in the laſt year of the reign of King Henry VIII. The liturgy of 5 and 6 Ed. VI. was re-eſtabliſhed with ſome few alterations and additions, by 1 Eliz. cap. 2. Some farther alterations were introduced, in conſequence of the review of the common prayer-book, by order of King James, in the firſt year of his reign; particularly in the office of private baptiſm, in ſeveral rubricks and other paſſages, with the addition of five or ſix new prayers and thankſgivings, and all that part of the catechiſm which contains the doctrine of the ſacraments. The book of common-prayer, ſo altered, remained in force from the firſt year of King James to the fourteenth of Charles II. But the laſt review of the liturgy was in the year 1661, and the laſt act of uniformity enjoining the obſervance of it is 13 and 14 Car. II. cap. 4. See *Common-Prayer*. Many applications have been ſince made for a review, but hitherto without ſucceſs.

LITUUS, among the Romans, was the ſtaff made uſe of by the augurs in quartering the heavens. It bore a great reſemblance to the croſier of a biſhop, but was ſhorter. It was crooked at one end, and thickeſt in the curved part, according to A. Gellius. We frequently meet with a repreſentation of it upon medals, amongſt other pontifical inſtruments. It was called *Lituus Quirinalis*, from Quirinus, a name of Romulus, who was ſkilled in all the myſteries of augury.

Lituus, was alſo an inſtrument of muſic in uſe in the Roman army. It was ſtraight, excepting that it had a little bending at the upper end like a lituus or ſacred ſtaff of the augurs; and from the ſimilitude it derived its name. The lituus, as an inſtrument of martial muſic, was of a middle kind, betwixt the cornu and the tuba.

LIVADIA, anciently *Achaia* and *Hellas*, or *Greece* properly ſo called; a province of Turky in Europe, bounded on the north by Epirus and Theſſaly, from which is is ſeparated by mount Oeta, now Banina, and by the Euripus, now the ſtrait of Negropont; on the eaſt, by the Archipelago; on the ſouth, by the gulf of Engia or Egina, the iſthmus of Corinth, and the gulf of Lepanto; and on the weſt, by the Ionian ſea and part of Epirus. Its extent is about 130 miles from north-weſt to ſouth-eaſt; but its greateſt breadth is not above 36 miles. It is in general a mountainous country; but neither unpleaſant nor unfruitful. The principal mountains are, mount Oeta in Bœotia, where is the famous paſs of Thermopylæ, not above 25 feet broad; and Parnaſſus, Helicon, and Cythæron in Phocis, which were ſacred to Apollo and the muſes, and conſequently much celebrated by the poets. The rivers of moſt note are, the Sionapro, anciently the Achelous, the Cephiſſus, the Iſmenus, and the Aſopus. The province is at preſent divided into Livadia proper, Stramulippa, and the duchy of Athens. The principal places are, Lepanto, anciently Naupactus; Livadia, anciently Libadia or Lebadia; the celebrated city of Athens, now Setines; Thebes, now Stibes; Lepſina, anciently Eleuſis; Caſtri, formerly Delphi; and Megara.

Livadia || Liver.

Livadia, an ancient town of Turky in Europe, and capital of a province of the ſame name in Greece. It is a large and populous place, ſeated on the gulf of Lepanto, about 25 miles from the city of that name. It has now a conſiderable trade in woollen ſtuffs and rice. Anciently it was celebrated for the oracle of Trophonius, which was in a cavern in a hill above the town. E. Long. 23. 29. N. Lat. 38. 40.

LIVER, in anatomy. See there, n° 96.—Plato, and other of the ancients, fix the principle of love in the liver; whence the Latin proverb, *Cogit amare jecur:* and in this ſenſe Horace frequently uſes the word, as when he ſays, *Si torrere jecur quæris Idoneum.* —The Greeks, from its concave figure, called it ηπαρ, "vaulted, ſuſpended;" the Latins call it *jecur*, q. d. *juxta cor*, as being "near the heart." The French call it *foye*, from *foyer*, *focus*, "or fire-place;" agreeable to the doctrine of the ancients, who believed the blood to be boiled and prepared in it.—Eraſiſtratus, at firſt, called it *parenchyma*, i. e. *effuſion*, or *maſs of blood;* and Hippocrates, by way of eminence, frequently calls it the *hypochondrium*.

Liver of Antimony. See Chemistry-*Index*.

Liver of Arſenic, is a combination of white arſenic with liquid fixed vegetable alkali, or by the humid way. Arſenic has in general a ſtrong diſpoſition to unite with alkalis. Mr Macquer, in his *Memoirs upon Arſenic*, mentions a ſingular kind of neutral ſalt, which reſults from the union of arſenic with the alkaline baſis of nitre, when nitre is decompoſed, and its acid is diſengaged in cloſe veſſels, by means of arſenic. To this ſalt he has given the name of *neutral arſenical ſalt* †. The liver of arſenic, mentioned alſo by that chemiſt, although compoſed, like the neutral arſenical ſalt, of arſenic and fixed alkali, is nevertheleſs very different from that ſalt.

† See Chemiſtry, *Index*.

The operation for making liver of arſenic is eaſy and ſimple. To ſtrong and concentrated liquid fixed alkali, previouſly heated, fine powder of white arſenic muſt be added. This arſenic eaſily diſappears and diſſolves, and as much of it is to be added till the alkali is ſaturated, or has loſt its alkaline properties, although it is ſtill capable of diſſolving more arſenic ſuperabundantly. While the alkali diſſolves the arſenic in this operation, it

Liver, Liverpool.

it acquires a browniſh colour, and a ſingular and diſagreeable ſmell; which, however, is not the ſmell of pure arſenic heated and volatilized. Laſtly, this mixture becomes more and more thick, and at length of a gluey conſiſtence. This matter is not cryſtallizable as the neutral arſenical ſalt is. It is eaſily decompoſed by the action of fire, which ſeparates the arſenic. This does not happen to the arſenical ſalt. Any pure acid is capable of ſeparating arſenic from the liver of arſenic, in the ſame manner as they ſeparate ſulphur from liver of ſulphur: whereas the neutral arſenical ſalt cannot be decompoſed but by means of the united affinities of acids and metallic ſubſtances. Thus we ſee that arſenic may be combined with fixed alkali in two very different manners.

The author has given to this combination the name of *liver of arſenic*, to diſtinguiſh it from the neutral arſenical ſalt, and in imitation of the name of the *liver of ſulphur*, given to the combination of the fixed alkali with ſulphur.

Liver of Sulphur. See Chemistry, *Index*.

Liver-Wort, in botany. See Marchantia and Lichen.

Liver-Stone, (lapis hepaticus); a genus of inflammable ſubſtances, containing, beſides its phlogiſton, argillaceous, ponderous, and ſiliceous earth, united with vitriolic acid. See Earths, §. 1. n° 4.

Mr Bergman, in his Sciagraphia, informs us, that 100 parts of this ſtone contain 33 of ſiliceous earth, 29 of cauſtic ponderous earth, almoſt 5 of argillaceous earth, and 3.7 of lime, beſides the vitriolic acid and water of cryſtalliſation: but Mr Kirwan quotes another analyſis of the ſame author, where it is ſaid that 100 parts of it contain 33 of baro-ſelenite, 38 of ſiliceous earth, 22 of alum, 7 of gypſum, and 5 of mineral oil.

LIVERPOOL, a large, flouriſhing, and populous town of England, in the county of Lancaſter, ſituated at the influx of the river Merſey into the ſea. This town has ſo much increaſed in trade ſince the commencement of the preſent century, that it is now the greateſt ſea-port in England except London, having exceeded Briſtol conſiderably of late years; which will appear by the following account of the cuſtom-duties, received in the ſeveral ports of London, Liverpool, and Briſtol, in the year 1784, taken from the report of the commiſſioners for inſpecting the ſtate of public accounts.

London, - -	L. 5,187,052	9	5 1/2
Liverpool, - -	640,684	2	2 1/2
Briſtol, - - -	334,909	19	3 1/2

Liverpol exceeded Briſtol, L. 305,774 2 11

The following ſhows how much the trade has increaſed ſince the above period:

Duties received in the port of Liverpool from July 5th 1787, to October 10th 1787. L. 298,361 9 10 1/2

The merchants here trade to all parts of the world except Turky and the Eaſt Indies; but the moſt beneficial trade is to Guinea and the Weſt Indies, by which many of them have acquired very large fortunes.

Liverpool, during the laſt war, carried on more foreign trade than any town in England; and ſuch is the ſtate of it at this time, that there are near three thouſand veſſels cleared from that port in one year to different parts of the world. Here are ſeveral manufactories for China-ware, and pot-houſes which make very fine ware, ſome ſalt-works, glaſs-houſes, and upwards of 50 breweries, from ſome of which large quantities of malt-liquor are ſent abroad. Many of the buildings are formed in the moſt elegant manner; but the old ſtreets are narrow; which defect will ſoon be removed, as the corporation have lately obtained an act of parliament for the improvement of the town, which they have already begun to put in force with great ſpirit, having taken down the principal ſtreets in the centre of the town, and rebuilt them in a ſpacious and moſt magnificent manner; ſo that in a few years it will be one of the handſomeſt towns in England. This town contains ten churches, namely, St Peter's, St Nicholas's, St George's, St Thomas's, St Paul's, St Ann's, St John's, St James's, St Catharine's, and St Mary's. There are alſo meetings for independents, anabaptiſts, quakers, methodiſts, and preſbyterians. The exchange is a noble ſtructure, built of white ſtone in the form of a ſquare, and round it are piazzas where the merchants aſſemble to tranſact buſineſs. Above it are the mayor's offices, the ſeſſions-hall, the council-chamber, and two elegant ball-rooms. The expence of erecting this building amounted to L. 30,000. The cuſtom-houſe is ſituated at the head of the old dock, and is a handſome and convenient ſtructure. Here are many charitable foundations, among which is an excellent grammar-ſchool well endowed, and many of the youth taught in it have exhibitions in the univerſities. The infirmary is a large edifice of brick and ſtone, ſituated on a hill in a very pleaſant airy ſituation, at one end of the town.

Liverpool.

In the town is a charity-ſchool ſupported by voluntary ſubſcriptions and contributions for 50 boys and 12 girls, who are not only clothed and educated, but alſo provided with food and lodging: likewiſe ſeveral alms houſes for the widows of ſeamen; and an excellent poor-houſe, ſuperior to any in the kingdom, where upwards of 800 men, women, and children, are ſupported, many of whom are employed in ſpinning cotton and wool. There are five large wet docks, three dry docks, and ſeveral graving docks for the repairing of ſhipping; which renders it the moſt commodious ſea-port in the world. The quays which bound theſe docks are covered with warehouſes; which is a convenience that enables the merchant to diſcharge his ſhip at a very ſmall expence. The new priſon lately finiſhed is a noble edifice, being built entirely on the plan of the great and benevolent Mr Howard, for ſolitary confinement; and is perhaps the moſt convenient, airy, magnificent building of the kind in Europe; being upon a very extenſive ſcale.

Liverpool received its charter from king John: it is under the government of a recorder, mayor, and an unlimited number of aldermen, two bailiffs, and a common-council of forty of the principal inhabitants, with a town-clerk and other proper officers. The town has a weekly market on Saturday, and is diſtant from London 204 miles. The progreſſive riſe of popula-

Liverpool, Livery.

tion in Liverpool, may be conceived by perusing the following table:

Year.	Christened.	Buried.	Married.
1660	3	—	—
1680	106	51	5
1700	132	124	35
1720	410	293	58
1740	485	608	137
1760	986	599	408
1780	1709	1544	606
1787	2267	1773	804

By the late inland navigation, Liverpool has communication with the rivers Dee, Ribble, Ouse, Trent, Darwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles, in the counties of Lincoln, Nottingham, York, Westmoreland, Chester, Stafford, Warwick, Leicester, Oxford, Worcester, &c. The Mersey, upon which the town is situated, abounds with salmon, cod, flounders, turbot, plaise, and smelts; and at full sea it is above two miles over. In the neighbourhood are frequent horse-races, on a five-mile course, the finest for the length in England. The soil in and near the town is dry and sandy, and particularly favourable to the growth of potatoes, on which the farmers often depend more than on wheat or any other grain. Fresh water is brought into the town by pipes, from some springs four miles off, pursuant to an act of parliament in the reign of Queen Anne. Liverpool sends two members to parliament.

LIVERY, in matters of dress and equipage, a certain colour and form of dress, by which noblemen and gentlemen choose to distinguish their servants.

Liveries are usually taken from fancy, or continued in families by succession. The ancient cavaliers, at their tournaments, distinguished themselves by wearing the liveries of their mistresses: thus people of quality make their domestics wear their livery.

Father Menestrier, in his Treatise of Carousals, has given a very ample account of the mixtures of colours in liveries. Dion tells us, that Oenomaus was the first who invented green and blue colours, for the troops which, in the circus, were to represent land and sea-fights.

The Romish church has also her several colours and liveries; white, for confessors and virgins, and in times of rejoicing; black, for the dead; red, for the apostles and martyrs; blue or violet, for penitents; and green, in times of hope.

Formerly, great men gave liveries to several, who were not of their family or servants, to engage them in their quarrels for that year; but this was prohibited by the statutes 1 Rich. II. 1 Hen. IV. cap. 27. 2 and 7 Hen. IV. 8 Hen. VI. cap. 4. 8 Ed. IV. cap. 2; and no man, of whatever condition, was allowed to give any livery, but to his domestic officers, and counsel learned in the law. However, most of the above statutes are repealed by 3 Car. I. cap. 4.

Livery of Seisin, in law, signifies delivering the possession of lands, &c. to him who has a right to them.

Liverymen, Livius.

LIVERYMEN of London, are a number of men chosen from among the freemen of each company. Out of this body the common-council, sheriff, and other superior officers for the government of the city, are elected; and they alone have the privilege of giving their votes for members of parliament, from which the rest of the citizens are excluded.

LIVIUS (Titus), the best of the Roman historians, as he is called by Mr Bayle, was born at Patavium, or Padua. Few particulars of his life have been handed down to us. Coming to Rome, he acquired the notice and favour of Augustus, and there he long resided. Some have supposed, (for there is not any proof of it), that he was known to Augustus before, by certain Philosophical Dialogues which he had dedicated to him. Seneca says nothing of the dedication: but mentions the dialogues, which he calls historical and philosophical; and also some books, written purposely on the subject of philosophy. Be this as it will, it is probable that he began his history as soon as he was settled at Rome; and he seems to have devoted himself so entirely to the great work he had undertaken, as to be perfectly regardless of his own advancement. The tumults and distractions of Rome frequently obliged him to retire to Naples; not only that he might be less interrupted in the pursuit of his destined task, but also enjoy that retirement and tranquillity which he could not have at Rome, and which yet he seems to have much sought after: for he was greatly dissatisfied with the manners of his age, and tells us, that "he should reap this reward of his labour, in composing the Roman history, that it would take his attention from the present numerous evils, at least while he was employed upon the first and earliest ages." He used to read parts of this history, while he was composing it, to Mecænas and Augustus; and the latter conceived so high an opinion of him, that he pitched upon him to superintend the education of his grandson Claudius, who was afterwards emperor. After the death of Augustus, Livy returned to the place of his birth, where he was received with all imaginable honour and respect; and there he died, in the fourth year of the reign of Tiberius, aged above seventy. Some say, he died on the same day with Ovid: it is certain that he died the same year.

Scarce any man was ever more honoured, alive as well as dead, than this historian. Pliny the younger relates, that a native gentleman travelled from Gades, in the extremest parts of Spain, to see Livy: and, though Rome abounded with more stupendous and curious spectacles than any city in the world, yet he immediately returned; as if, after having seen Livy, nothing farther could be worthy of his notice. A monument was erected to this historian in the temple of Juno, where was afterwards founded the monastery of St Justina. There, in 1413, was discovered the following epitaph upon Livy: *Ossa Titi Livii Patavini, omnium mortalium judicio digni, cujus prope invicto calamo invicti populi Romani res gestæ conscriberentur;* that is, "The bones of Titus Livius of Patavium, a man worthy to be approved by all mankind, by whose almost invincible pen the acts and exploits of the invincible Romans

Livius.

mans were written." Theſe bones are ſaid to be preſerved with high reverence to this day, and are ſhown by the Paduans as the moſt precious remains. In 1451, Alphonſus, king of Arragon, ſent his ambaſſador, Anthony Panormita, to deſire of the citizens of Padua the bone of that arm with which this their famous countryman had written his hiſtory: and, obtaining it, cauſed it to be conveyed to Naples with the greateſt ceremony as a moſt invaluable relic. He is ſaid to have recovered from an ill ſtate of health by the pleaſure he found in reading this hiſtory: and therefore, out of gratitude, put upon doing extraordinary honours to the memory of the writer. Panormita alſo, who was a native of Palermo in Sicily, and one of the ableſt men of the 15th century, ſold an eſtate to purchaſe this hiſtorian.

The hiſtory of Livy, like other great works of antiquity, is tranſmitted down to us exceedingly mutilated and imperfect. Its books were originally an hundred and forty-two, of which are extant only thirty-five. The epitomes of it, from which we learn their number, all remain, except thoſe of the 136th and 137th books. Livy's books have been divided into decades, which ſome will have to have been done by Livy himſelf, becauſe there is a preface to every decade; while others ſuppoſe it to be a modern contrivance, ſince nothing about it can be gathered from the ancients. The firſt decade, beginning with the foundation of Rome, is extant, and treats of the affairs of 460 years. The ſecond decade is loſt; the years of which are ſeventy-five. The third decade is extant, and contains the ſecond Punic war, including eighteen years. It is reckoned the moſt excellent part of the hiſtory, as giving an account of a very long and ſharp war, in which the Romans gained ſo many advantages, that no arms could afterwards withſtand them. The fourth decade contains the Macedonian war againſt Philip, and the Aſiatic war againſt Antiochus, which takes up the ſpace of about 23 years. The five firſt books of the fifth decade were found at Worms, by Simon Grynæus, in 1431, but are very defective; and the remainder of Livy's hiſtory, which reaches to the death of Druſus in Germany in 746, together with the ſecond decade, are ſupplied by Freinſhemius.

Never man perhaps was furniſhed with greater advantages for writing a hiſtory than Livy. Beſides his own great genius, which was in every reſpect admirably formed for the purpoſe, he was trained as it were in a city, at that time the empreſs of the world, and in the politeſt reign that ever was; having ſcarcely had any other ſchool than the court of Auguſtus. He had acceſs to the very beſt materials, ſuch as the Memoirs of Sylla, Cæſar, Labienus, Pollio, Auguſtus, and others, written by themſelves. "What writers of memorials (ſays Lord Bolinbroke), what compilers of the Materia Hiſtorica, were theſe! What genius was neceſſary to finiſh up the pictures that ſuch maſters had ſketched! Rome afforded men that were equal to the taſk. Let the remains, the precious remains, of Salluſt, of Livy, and of Tacitus, witneſs this truth.—— What a ſchool of public and private virtue had been opened to us at the reſurrection of learning, if the latter hiſtorians of the Roman commonwealth, and the firſt of the ſucceeding monarchy, had come down to us entire! The few that are come down, though broken and imperfect, compoſe the beſt body of hiſtory that we have; nay, the only body of ancient hiſtory that deſerves to be an object of ſtudy. It fails us indeed moſt at that remarkable and fatal period, where our reaſonable curioſity is raiſed the higheſt. Livy employed forty-five books to bring his hiſtory down to the end of the ſixth century, and the breaking out of the third Punic war: but he employed ninety-five to bring it down from thence to the death of Druſus; that is, through the courſe of 120 or 130 years. Appian, Dion Caſſius, and others, nay, even Plutarch included, make us but poor amends for what is loſt of Livy." Speaking then of Tully's orations and letters, as the beſt adventitious helps to ſupply this loſs, he ſays, that "the age in which Livy flouriſhed, abounded with ſuch materials as theſe: they were freſh, they were authentic: it was eaſy to procure them; it was ſafe to employ them. How he did employ them in executing the ſecond part of his deſign, we may judge from his execution of the firſt; and, I own, I ſhould be glad to exchange, if it were poſſible, what we have of this hiſtory for what we have not. Would you not be glad, my lord, to ſee, in one ſtupendous draught, the whole progreſs of that government from liberty to ſervitude; the whole ſeries of cauſes and effects, apparent and real, public and private?" &c.

The encomiums beſtowed upon Livy, by both ancients and moderns, are great and numerous. He not only entertains like Herodotus; he alſo inſtructs and intereſts in the deepeſt manner. But the great probity, candour, and impartiality, are what have diſtinguiſhed Livy above all hiſtorians; for neither complaiſance to the times, nor his particular connections with the emperor, could reſtrain him from ſpeaking well of Pompey; ſo well, as to make Auguſtus call him a *Pompeian*. This we learn from Cremutius Cordus, in Tacitus; who relates alſo, much to the emperor's honour, that this gave no interruption to their friendſhip. But whatever elogies Livy may have received as an hiſtorian, he has not eſcaped cenſure as a writer. In the age wherein he lived, Aſinius Pollio charged him with Patavinity; which Patavinity has been variouſly explained by various writers, but is generally ſuppoſed to relate to his ſtyle. The moſt common is, that this noble Roman, accuſtomed to the delicacy of the language ſpoken in the court of Auguſtus, could not bear with certain provincial idioms, which Livy, as a Paduan, uſed in divers places of his hiſtory. Pignorius is of another mind, and believes that this Patavinity regarded the orthography of certain words, wherein Livy uſed one letter for another, according to the cuſtom of his country, writing *ſibe* and *quaſe* for *ſibi* and *quaſi*; which he attempts to prove by ſeveral ancient inſcriptions. The expreſſions, however, or the orthography of words, are not loaded with obſcurity, and the perfect claſſic is as familiarly acquainted with thoſe ſuppoſed provincialiſms as with the pureſt Latinity.—Livy has been cenſured too, and perhaps with juſtice, for being too credulous, and burdening his hiſtory with vulgar notions and ſuperſtitious tales. He may diſguſt when he mentions that milk and blood were rained from heaven, or that an ox ſpoke or a woman changed her ſex; yet he candidly confeſſes that he recorded only what made an indelible impreſſion upon the minds of a credulous age.

Is it worth while to mention here the capricious

Livius. and tyrannic humour of the emperor Caligula, who accuſed Livy of being a negligent and wordy writer, and reſolved therefore to remove his works and ſtatues out of all libraries, where he knew they were curiouſly preſerved? Or the ſame humour in Domitian, another prodigy of nature, who put to death Metius Pompoſianus, becauſe he made a collection of ſome orations of kings and generals out of Livy's hiſtory? Pope Gregory the Great, alſo, would not ſuffer Livy in any Chriſtian library, becauſe of the Pagan ſuperſtition wherewith he abounded: but the ſame reaſon held good againſt all ancient authors; and indeed Gregory's zeal was far from being levelled at Livy in particular, the pontiff having declared war againſt all human learning.

Though we know nothing of Livy's family, yet we learn from Quintilian, that he had a ſon, to whom he addreſſed ſome excellent precepts in rhetoric. An ancient inſcription ſpeaks alſo of one of his daughters, named *Livia Quarta*: the ſame, perhaps, that eſpouſed the orator Lucius Magius, whom Seneca mentions; and obſerves, that the applauſes he uſually received from the public in his harangues, were not ſo much on his own account, as for the ſake of his father in law.

Our author's hiſtory has been often publiſhed with and without the ſupplement of Freinſhemius. The beſt editions are, that of Gronovius, *cum notis variorum & ſuis*, Lugd. Bat. 1679, 3 vol. 8vo; that of Le Clerc, at Amſterdam, 1709, 10 vol. 12mo; and that of Crevier, at Paris, 1735, 6 vol. 4to. Theſe have the ſupplements.—Learning perhaps never ſuſtained a greater loſs, in any ſingle author, than by the deſtruction of the latter and more intereſting part of Livy. Several eminent moderns have indulged the pleaſing expectation that the entire work of this noble hiſtorian might yet be recovered. It has been ſaid to exiſt in an Arabic verſion: and even a complete copy of the original is ſuppoſed to have been extant as late as the year 1631, and to have periſhed at that time in the plunder of Magdeburgh. The munificent patron of learning, Leo X. exerted the moſt generous zeal to reſcue from oblivion the valuable treaſure, which one of his moſt bigotted predeceſſors, above mentioned, had expelled from every Chriſtian library. Bayle has preſerved, under the article Leo, two curious original letters of that pontiff, concerning his hopes of recovering Livy; which afford moſt honourable proofs of his liberality in the cauſe of letters.—A lately diſcovered fragment of Livy's hiſtory was publiſhed in 1773 by Dr Bruns.

Livius (Andronicus), a comic poet who flouriſhed at Rome about 240 years before the Chriſtian era. He was the firſt who turned the perſonal ſatyrs and feſcennine verſes, ſo long the admiration of the Romans, into the form of a proper dialogue and regular play. Though the character of a player, ſo valued and applauded in Greece, was reckoned vile and deſpicable among the Romans, Andronicus acted a part in his dramatical compoſitions, and engaged the attention of his audience, by repeating what he had laboured after the manner of the Greeks. Andronicus was the freedman of M. Livius Salinator, whoſe children he educated. His poetry was grown obſolete in the age of Cicero, whoſe nicety and judgment would not even recommend the reading of it.

Livonia ‖ Lixnaw.

LIVONIA, a large province of the Ruſſian empire, with the title of a duchy. It is bounded on the north by the gulph of Finland, on the weſt by that of Riga, on the ſouth by Courland, and on the eaſt, partly by Pleſcow, and partly by Novogorod. It is about 250 miles from north to ſouth, and 150 from eaſt to weſt. The land is ſo fertile in corn, that it is called the *granary of the north*; and would produce a great deal more, if it was not ſo full of lakes. The fiſh that abound here are ſalmons, carps, pikes, flat fiſh, and many others. In the foreſts there are wolves, bears, elks, rein-deer, ſtags, and hares. The domeſtic animals are very numerous; but the ſheep bear very bad wool. Here are a great number of foreſts, which conſiſt of birch-trees, pines, and oaks; and all the houſes of the inhabitants are built with wood. The merchandizes which they ſend abroad are flax, hemp, honey, wax, leather ſkins, and potaſhes. The Swedes were formerly poſſeſſed of this province, but were obliged to abandon it to the Ruſſians after the battle of Pultowa; and it was ceded to them by the peace of the North, concluded in 1722, which was confirmed by another treaty in 1742. It is divided into two provinces, viz. Letonia and Eſtonia; and two iſlands called *Oeſel* and *Dagho*, which are again ſubdivided into ſeveral diſtricts.

LIVONICA-TERRA, a kind of fine bole uſed in the ſhops of Germany and Italy. It is found in Livonia, from whence it takes its name, and alſo in ſome other parts of the world. It is generally brought to us in little cakes, ſealed with the impreſſion of a church and an eſcutcheon, with two croſs keys.

LIVRE, a French money of account, containing 20 ſols. See *Money-Table*.

LIXA, or LIXUS (anc. geog.) a town on the Atlantic near the river Lixus; made a Roman colony by Claudius Cæſar; famous in mythology for the palace of Anteus and his encounter with Hercules, (Pliny). Now *Larache*, ſixty-five leagues to the ſouth of the ſtraits of Gibraltar.

LIXIVIOUS, an appellation given to ſalts obtained from burnt vegetables by pouring water on their aſhes.

LIXIVIUM, in pharmacy, &c. a ley obtained by pouring ſome liquor upon the aſhes of plants; which is more or leſs powerful, as it has imbibed the fixed ſalts contained in the aſhes.

LIXNAW, a barony in the county of Kerry and province of Munſter in Ireland, which gives title of Baron to the earls of Kerry; the village here of this name being their ancient ſeat, where the caſtle was erected. This ſeat ſtands agreeably on the river Brick, which is here cut into ſeveral pleaſant canals, that adorn its plantations and gardens; the improvements are extenſive, moſt of the viſtoes and avenues terminating by different buildings, ſeats, and farm-houſes. The tide flows up to the gardens, whereby boats of a conſiderable burden may bring up goods to the bridge near the houſe: here are two ſtone-bridges over the Brick, the oldeſt of which was built by Nicholas the third baron Lixnaw, who was the firſt perſon that made cauſeways to this place, the land being naturally wet

Lizard ‖ Load.

wet and marſhy. W. Long. 9. 15. N. Lat. 52. 15.

LIZARD, in zoology. See LACERTA.

LIZARD, in geography, a cape or promontory of Cornwall, ſituated, according to the moſt common computation, in W. Long. 5. 47. N. Lat. 49. 50.

LLANDAFF. See LANDAFF.

LLOYD (Nicholas), a learned Engliſh writer in the 17th century, was born in Flintſhire in England, and educated at Wadham college, Oxford. He was rector of Newington St Mary near Lambeth in Surry, till his death, which happened in 1680. His *Dictionarium Hiſtoricum* is a valuable work, to which Hoffman and Moreri are greatly indebted.

LLOYD (William), a moſt learned Engliſh writer and biſhop, was born in Berkſhire in England in 1627. He was educated under his father, rector of Sonning, and vicar of Tyle-hurſt in Berkſhire; then went to Oxford, and took orders. In 1660 he was made prebendary of Rippon; and in 1666 chaplain to the king. In 1667 he took the degree of doctor of divinity; in 1672 he was inſtalled dean of Bangor; and in 1680 was conſecrated biſhop of St Aſaph. He was one of the ſix biſhops who, with archbiſhop Sancroft, were committed priſoners to the Tower of London, for ſubſcribing a petition to the king againſt diſtributing and publiſhing his declaration for liberty of conſcience. Soon after the revolution he was made almoner to king William and queen Mary: in 1692 he was tranſlated to the biſhopric of Litchfield and Coventry; and in 1699, to the ſee of Worceſter, where he ſat till his death, which happened in 1717, the 91ſt year of his age. Dr Burnet gives him an exalted character, and his works are highly eſteemed.

LOACH, in ichthyology. See COBITIS.

LOAD, or LODE, in mining, a word uſed eſpecially in the tin-mines, for any regular vein or courſe, whether metallic or not; but moſt commonly load means a metallic vein.

It is to be obſerved, that mines in general are veins or cavities within the earth, whoſe ſides receding from or approaching to each other, make them of unequal breadths in different places, ſometimes forming large ſpaces, which are called *holes*; theſe holes are filled like the reſt with ſubſtances, which, whether metallic, or of any other nature, are called *loads*. When the ſubſtances forming theſe loads are reducible to metal, the loads are by the Engliſh miners ſaid to be alive, otherwiſe they are termed dead loads.

In Cornwall and Devonſhire the loads all hold their courſe from eaſtward to weſtward, tho' in other parts of England they frequently run from north to ſouth. The miners report, that the ſides of the load never bear in a perpendicular, but always overhang either to the north or ſouth above. The mines ſeem to have been ſo many channels through which the waters paſs within the earth; and like rivers they have their ſmall branches opening into them in all directions: theſe are by the miners termed the feeders of the load. Moſt mines have ſtreams of water running through them; and when they are found dry, it ſeems owing to the water having changed its courſe, which it ſeems ſometimes to have been compelled to by the load's having filled up the courſe, and ſometimes to have fallen into other more eaſy channels.

The load is frequently intercepted by the croſſing of a vein of earth or ſtone, or ſome other metalline ſubſtance; in which caſe it generally happens, that one part of the load is moved to a conſiderable diſtance on one ſide. This tranſient load is, by the miners, termed a *flooking*; and the part of the load which is moved, is by them ſaid to be *heaved*. This fracture or heave of a load, according to Mr Price, is produced by a ſubſidence of the ſtrata from their primary poſitions, which he ſuppoſes to have been horizontal or parallel to the ſurface of the earth, and therefore ſhould more properly be called a depreſſion than a heave. This heaving of the load would be an inexpreſſible loſs to the miner, did not experience teach him, that as the loads always run on the ſides of the hills, ſo the part heaved is always moved toward the deſcent of the hill; ſo that the miner, working toward the aſcent of the hill, and meeting a flooking, conſiders himſelf as working in the heaved part; wherefore, cutting through the flooking, he works upon its back up the aſcent of the hill, till he recovers the load, and *vice verſa*.

Load ‖ Loango.

LOAD is alſo uſed for nine diſhes of ore, each diſh being about half a hundred weight.

LOADSTONE. See MAGNET.

LOAMS, in natural hiſtory, are defined to be earths compoſed of diſſimilar particles, ſtiff, denſe, hard, and rough to the touch; not eaſily broke while moiſt, readily diffuſible in water, and compoſed of ſand and a tough viſcid clay. Of theſe loams ſome are whitiſh and others brown and yellow.

LOAN, any thing given to another, on condition of return or payment.

Public Loans. See FUNDS, and *NATIONAL Debt*.

LOANDA, a province of the kingdom of Angola in Africa. It is an iſland about 15 miles in length, and three in breadth; remarkable chiefly for the capital of Angola ſituated upon it, in E. Long. 12. 25. S. Lat. 8. 45. This town was built by the Portugueſe in 1578, under the direction of the firſt Portugueſe governor in theſe parts. It is large, populous, and pleaſantly ſeated on the declivity of a hill near the ſea-coaſt, and facing the ſouth-weſt. The iſland is ſupplied with freſh water from wells dug in it; and which are not ſunk below the depth of three feet when they are filled with excellent water. It is remarkable, however, that the water of theſe wells continues good only during the time of high-tide; for, as that ſinks, the water becomes more and more brackiſh, till at laſt it is quite ſalt, almoſt as much as the ſea itſelf. On the coaſt of this iſland are fiſhed the zimbis, or ſhells uſed in ſeveral parts of Africa inſtead of money; and with theſe ſhells, inſtead of coin, is carried on a great part of the traffic of this country.

LOANGO, a kingdom of Africa, extending itſelf about 180 geographical miles in length from ſouth to north; that is, from cape St Catharine under the ſecond degree of ſouth latitude, to a ſmall river called *Lovanda Louiſia*, on the 5th degree of the ſame. From weſt to eaſt it extends from Cape Negro on the coaſt of Ethiopia towards the *Buchumalean* mountains, ſo called on account of their vaſt quantity of ivory and great droves of elephants, about 300 miles. It is divided into four principal provinces, viz. thoſe of Lovangiri, Loango-mongo, Chilongo, and Piri.

The inhabitants are very black, well-ſhaped, and of a mild temper. The men wear long petticoats, from the waiſt downwards, and have round their waiſt a

piece

Loango || Lobelia.

piece of cloth half an ell or a quarter broad, over which they wear the ſkin of a leopard, or ſome other wild beaſt, hanging before them like an apron. On their head they wear a cap made of graſs, and quilted, with a feather a-top of it; and on their ſhoulder, or in their hand, they carry a buffalo's tail, to drive away the muſkettos. The womens petticoats are made only of ſtraw, about an ell ſquare, with which they cover their privities, but leave the greateſt part of their thighs and buttocks bare: the reſt of their body is quite bare, except that on their legs they wear little ſtrings of beads made of ſhells, and ſmall bracelets of ivory on their arms. They anoint themſelves with palm-oil, mixed with a kind of red wood reduced to powder.

This country abounds with poultry, oxen, cows, ſheep, goats, elephants, tigers, leopards, civet-cats, and other animals; ſo that here are great quantities of elephants teeth, and fine furs, to be traded for.

The capital city, where the king reſides, is called *Loango*, or *Banza-Loangeri*, and, in the language of the negroes, *Boaric*. This city is ſituated in South Lat. $4\frac{1}{2}$ degrees, a league and a half from the ſea-coaſt. It is a pretty large city, ſhaded and adorned with bananas, palm, and other trees. The king, who reſides in a large palace in the middle of it, has about 1500 concubines. If any of them is ſurpriſed in adultery, ſhe and her paramour are inſtantly conveyed to the top of a very high hill, whence they are hurled down headlong from the ſteepeſt place.

Every man marries as many wives here as he pleaſes, who are obliged to get their huſbands a livelihood, as is the practice all along the African coaſt inhabited by blacks. The women, therefore, cultivate the land, ſow and reap, while the lazy huſbands loiter away their time in idleneſs.

The king's revenue conſiſts in elephants teeth, copper, and a kind of petticoats made of palm-tree leaves, and called *lavogus*: he has whole ſtore-houſes full of theſe lavogus; but his greateſt riches conſiſt in ſlaves of both ſexes.

LOBBY, in architecture, is a ſmall hall or waiting-room: it is alſo an entrance into a principal apartment, where there is a conſiderable ſpace between that and a portico or veſtibule, and the length or dimenſions will not allow it to be conſidered as a veſtibule or an anti-room. See ANTICHAMBER.

LOBE, in anatomy, any fleſhy protuberant part, as the lobes of the lungs, the lobes of the ears, &c.

LOBELIA, CARDINAL-FLOWER: A genus of the monogamia order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 29th order, *Campanaceæ*. The calyx is quinquefid; the corolla monopetalous, and irregular; the capſule inferior, bilocular, or trilocular. There is a great number of ſpecies, but only four of them are cultivated in our gardens; two of which are hardy herbaceous plants for the open ground, and two ſhrubby plants for the ſtove. They are all fibrous rooted perennials, riſing with erect ſtalks from two to five or ſix feet high, ornamented with oblong, oval, ſpear-ſhaped, ſimple leaves; and ſpikes of beautiful monopetalous, ſomewhat ringent, five-parted flowers, of ſcarlet, blue, and violet colours. They are eaſily propagated by ſeeds, offsets, and cuttings of their ſtalks. The tender kinds require the common treatment of other exotics. They are natives of America; from which their ſeeds muſt be procured. Lobetum || Locarno.

The root of a ſpecies called the *ſiphilitica* is an article of the materia medica. This ſpecies grows in moiſt places in Virginia, and bears our winters. It is perennial, has an erect ſtalk three or four feet high, blue flowers, a milky juice, and a rank ſmell. The root conſiſts of white fibres about two inches long, reſembles tobacco in taſte, which remains on the tongue, and is apt to excite vomiting. It is uſed by the North American Indians as a ſpecifie in the venereal diſeaſe. The form is that of decoction; the doſe of which is ordered to be gradually increaſed till it bring on very conſiderable purging, then to be intermitted for a little, and again uſed in a more moderate degree till the cure be completed. The ulcers are alſo waſhed with the decoction, and the Indians are ſaid to ſprinkle them with the powder of the inner bark of the ſpruce tree. The ſame ſtrictneſs of regimen is ordered as during a ſalivation or mercurial courſe. The benefit to be derived from this article has not, as far as we know, been confirmed either in Britain or by the practitioners in Virginia: for there, as well as in this country, recourſe is almoſt univerſally had to the uſe of mercury; and it is probably from this reaſon that the London college have not received it into their liſt. It, however, ſeems to be an article which, in ſome caſes at leaſt, deſerves a trial.

LOBETUM, anciently a town of the Hither Spain: ſaid to have been built by the Libyan Hercules, (Pliny.) Now *Albarazin*, a town of Arragon on the confines of New Caſtile, on the river Guadalavir. E. Long. 2. N. Lat. 40. 40.

LOBINEAU (Guy Alexis), a Benedictine monk, born at Renne. in 1666, ſpent his whole life in the ſtudy of hiſtory, and the writing of ſeveral works; the principal of which are, The hiſtory of Brittany, 2 vols folio; and A continuation of Felibien's hiſtory of Paris, 9 vols folio. He died in 1727.

LOBO (Rodriguez Francis), a celebrated Portugueſe poet, was born at Leiria, a ſmall town of Eſtramadura. He wrote an heroic poem, ſome eclogues, and a piece intitled *Euphroſyne*, which is the favourite comedy of the Portugueſe. His works were collected and printed together in Portugueſe in 1721, in folio. He flouriſhed about 1610.

LOBO (Jerome), a famous Portugueſe Jeſuit, born at Liſbon, went into Ethiopia, and dwelt there for a long time. At his return he was made rector of the college of Coimbra, where he died in 1678. He wrote An hiſtorical account of Abyſſinia, which is by ſome eſteemed a very accurate performance.

LOBSTER, in zoology, a ſpecies of cancer. See CANCER.

LOCAL, in law, ſomething fixed to the freehold, or tied to a certain place: thus, real actions are local, ſince they muſt be brought in the country where they lie; and local cuſtoms are thoſe peculiar to certain countries and places.

Local Medicines, thoſe deſtined to act upon particular parts; as fomentations, epithems, veſicatories, &c.

LOCARNO, a town of Swiſſerland, capital of a bailiwick of the ſame name, ſeated at the north end

Locatellus ‖ Lochia.

of the lake Maggiore, near the river Magie. It carries on a great trade; and the country abounds in paſtures, wine, and fruits. E. Long. 8. 41. N. Lat. 46. 6.

LOCATELLUS's BALSAM. See PHARMACY-*Index*.

LOCHABER, a diſtrict of the ſhire of Inverneſs in Scotland. It is bounded by Moydart on the weſt, Glengary on the north, Badenoch on the eaſt, and Lorn on the ſouth. It derives its name from the lake or loch Aber; and extends about 20 miles from eaſt to weſt, and 30 from north to ſouth. The country is barren, bleak, mountainous, and rugged. In one of the moſt barren parts of this country, near the mouth of the river Aber, in the centre between the Weſt and North Highlands, ſtands Fort-William, with the town of Maryburgh, built upon a navigable arm of the ſea, not far from the foot of a very high mountain, called *Benevis*. The town, deſigned as a ſutlery for the garriſon, was erected into a borough; and the fort itſelf was deſigned as a check upon the clan Cameron, who had been guilty of depredations and other irregularities. It is inhabited moſtly by the Macdonalds, Camerons, and Mackintoſhes; who are not the moſt civilized people in Scotland, though their chiefs are generally perſons of education, honour, and hoſpitality. Macdonald of Glengary, deſcended in a ſtraight line from Donald of the Iſles, poſſeſſed a ſeat or caſtle in this diſtrict, which was burnt to the ground, and deſtroyed in the year 1715, in conſequence of his declaring for the Pretender. The elegant houſe and gardens belonging to Cameron of Lochiel underwent the ſame fate, for the ſame reaſon, after the extinction of the rebellion in the year 1746. The cadets of theſe families, which have formed a kind of inferior gentry, are lazy, indigent, and uncleanly; proud, ferocious, and vindictive. The common people, though celebrated for their bravery, fidelity, and attachment to their chiefs, are counted very ſavage, and much addicted to rapine. They ſpeak the Erſe language, and conform to the cuſtoms we have deſcribed as peculiar to the Highlanders. They pay very little attention to any ſort of commerce but that which conſiſts in the ſale of their black cattle, and lead a ſort of vagrant life among the hills; hunting, fowling, and fiſhing, as the ſeaſons permit, and as their occaſions require. They delight in arms, which they learn to handle from their infancy; ſubmit patiently to diſcipline in the character of ſoldiers; and never fail to ſignalize themſelves in the field by their ſobriety, as well as their valour. While they remain in their own country, nothing can be more penurious, mean, ſordid, and uncomfortable, than the way of life to which theſe poor people are inured, whether we conſider their dreſs, diet, or lodging. In point of proviſion, they are ſo improvident or ill ſupplied, that, before the winter is over, whole families are in danger of ſtarving. In this emergency, they bleed their miſerable cattle, already reduced to ſkin and bone, and eat the blood boiled with oatmeal. This evacuation, added to their former weakneſs, enfeebles the cows to ſuch a degree, that when they lie down they cannot riſe again without aſſiſtance.

LOCHIA, in midwifery, a flux from the uterus conſequent to delivery. See MIDWIFERY.

Lock.

LOCK, a well-known inſtrument uſed for faſtening doors, cheſts, &c. generally opened by a key.

The lock is reckoned the maſter-piece in ſmithery; a great deal of art and delicacy being required in contriving and varying the wards, ſprings, bolts, &c. and adjuſting them to the places where they are to be uſed, and to the various occaſions of uſing them.

From the various ſtructure of locks, accommodated to their different intentions, they acquire various names. Thoſe placed on outer-doors are called *ſtock-locks;* thoſe on chamber-doors, *ſpring-locks;* thoſe on trunks, *trunk-locks*, *pad-locks*, &c.

Of theſe the ſpring-lock is the moſt conſiderable, both for its frequency and the curioſity of its ſtructure. Its principal parts are, the main-plate, the cover-plate, and the pin-hole: to the main-plate belong the key-hole, top-hook, croſs-wards, bolt-toe or bolt-knab, drawback-ſpring tumbler, pin of the tumbler, and the ſtaples; to the cover-plate belong the pin, main-ward, croſs-ward, ſtep-ward or dap-ward; to the pin-hole belong the hook-ward, main croſs-ward, ſhank, the pot or bread, bow-ward, and bit.

As on the proper conſtruction of locks the ſecurity of the moſt valuable kinds of property almoſt entirely depends, and as numberleſs devices are continually fallen upon to elude the utmoſt efforts of mechanical invention in this reſpect, it thence becomes an object of no ſmall importance to invent a lock which it ſhould be *impoſſible* to open except by its proper key. A treatiſe upon this ſubject has been publiſhed by Mr Joſeph Brama; who is confident that he has brought the matter to the requiſite perfection, and that every one may reſt aſſured of the ſecurity of his property when under the protection of a lock of his invention. He begins with obſerving, that the principle on which all locks depend, is the application of a lever to an interior bolt, by means of a communication from without; ſo that, by means of the latter, the lever acts upon the bolt, and moves it in ſuch a manner as to ſecure the lid or door from being opened by any pull or puſh from without. The ſecurity of locks in general therefore depends on the number of impediments we can interpoſe betwixt the lever (the key) and the bolt which ſecures the door; and theſe impediments are well known by the name of *wards*, the number and intricacy of which alone are ſuppoſed to diſtinguiſh a good lock from a bad one. If theſe wards, however, do not in an effectual manner preclude the acceſs of *all* other inſtruments beſides the proper key, it is ſtill poſſible for a mechanic of equal ſkill with the lock-maker to open it without the key, and thus to elude the labour of the other.

"Locks (ſays our author) have been conſtructed, and are at preſent much uſed and held in great eſteem, from which the picklock is excluded: but the admiſſion of falſe keys is an imperfection for which no lock-ſmith has ever found a corrective; nor can this imperfection be remedied whilſt the protection of the bolt is wholly confided to *fixed wards*." This poſition is proved by a remark, that the wards, let them be as intricate as we pleaſe, muſt all be expreſſed on what is called the *bit* or *web* of the key: and therefore, when all the varieties that can be expreſſed on this bit or web have been run through, every ſucceeding lock muſt be the counterpart of ſome other; and conſequently the

ſame

Lock. same key which opens one will open the other alſo. This is evident from the locks uſually put upon drawers; and which, though they ſhould be made to reſiſt the picklock, are ſtill liable to be opened by ten thouſand other keys beſides that appropriated to each of them. But though the variety of wards could be augmented even to infinity, ſtill there could be no ſecurity againſt falſe keys; for as every one of the wards muſt be expreſſed on the web of the key, if another key with a web quite plain be made to fit the key-hole exactly, we have only to cover it over with ſome colouring ſubſtance upon which the wards may make an impreſſion; after which, it is eaſy to cut out the web in a proper manner for admitting them, when the lock will be as eaſily opened by the falſe as by the true key.

The firſt perſon, according to our author, who had any claim to merit in the branch of lock-making, is Mr Baron; whoſe lock he acknowledges to be by far more perfect and ſecure than any that ever appeared before; though he ſtill conſiders it as unfit for giving that abſolute ſecurity which is to be wiſhed for. His improvement conſiſted in the proper application of what are called *tumblers*. "Theſe (ſays Mr Bramah) are a kind of grapple; by which the bolt is confined, as well in its active as in its paſſive ſtation, and rendered immoveable till ſet at liberty by the key. One of theſe inſtruments is commonly introduced into all locks that are of any uſe or value; it is lodged behind the bolt, and is governed by a ſpring which acts upon the tumbler as the tumbler acts upon the bolt: The application therefore of any force to the tumbler, which is ſuperior to the force of the ſpring, will cauſe it to quit its hold, and ſet the bolt at liberty." In the common method of applying theſe machines, however, it matters nothing how far the tumbler is lifted above the point at which it ceaſes to control the bolt; but it is otherwiſe in thoſe of Mr Baron's conſtruction. The action of his tumblers is circumſcribed by a certain ſpace cut in the centre of the bolt, of dimenſions ſufficient only to anſwer the purpoſe intended. The ſpace in which the tumbler moves is an oblong ſquare; and is not only furniſhed with niches on the underſide into which the hooks of the tumblers are forced by the ſpring as in other locks, but is provided with correſpondent niches on the other ſide, into which the hooks are driven, if any greater force be applied to the tumblers than what is juſt ſufficient to diſengage them from the bolt. Hence it becomes abſolutely neceſſary, in the making of a falſe key, to conſtruct it in ſuch a manner, that it may with the greateſt exactneſs give the requiſite degree of preſſure, and no more.

Mr Bramah allows that this is a very great improvement, but objects that it is ſtill poſſible to frame a key which will open it as well as its own; nor will the addition of any number of tumblers preclude the poſſibility of opening it. "By giving (ſays he) an uniform motion to the tumblers, and preſenting them with a face which exactly tallies with the key, they ſtill partake, in a very great degree, of the nature of *fixed wards;* and the ſecurity of his lock is thereby rendered in a proportionable degree defective. Thus, ſuppoſe the falſe key to have paſſed the wards, and to be in contact with the moſt prominent of the tumblers, the impreſſion, which the ſlighteſt touch will leave on the key, will direct the application of the file till ſufficient ſpace is prepared to give it a free paſſage. The key will then bear upon a more remote tumbler; which difficulty being in like manner got over, the lock will be as eaſily opened by the falſe as by the true key." Lock.

This ſeemingly inſuperable objection to the perfection of lock-making, however, our author removes with the greateſt eaſe imaginable, by cauſing the tumblers which project unequally to preſent a *plane* ſurface: whence they would require a ſeparate and unequal motion to diſengage them; of conſequence no diſtinct impreſſion could be made by them upon the plane ſurface of the web that would give any idea of their poſitions with regard to one another, and the conſtruction of a falſe key would be altogether impoſſible.

But though the principal difficulty with regard to Mr Baron's lock be now overcome, others ſtill occur, *viz.* the difficulty of making locks which are conſtructed with tumblers ſufficiently durable. The tumblers themſelves, he obſerves, muſt be but ſlightly made; and being expoſed to perpetual friction by the key and their own proper motion, they muſt ſoon decay; and the keys of Mr Baron's locks, he alſo obſerves, are much leſs durable than thoſe of any other locks he ever ſaw.

With regard to the lock which Mr Bramah preſents to the public as abſolutely perfect, he informs us, that the idea of conſtructing it was firſt ſuggeſted by the alarming increaſe of houſe-robberies, which may reaſonably be ſuppoſed to be perpetrated in a great meaſure by perfidious ſervants, or accompliſhed by their connivance. Thus it is evident, that the locks which might exclude ordinary houſe-breakers could be no ſecurity againſt faithleſs ſervants, who having conſtant acceſs to the locks, might eaſily get falſe keys fabricated at their leiſure. In conſidering the ſubject, our author was convinced, that his hope of ſucceſs depended entirely upon his uſing means as diſſimilar as poſſible to thoſe by which the old locks were conſtructed; as theſe, however varied, had been found inſufficient for the purpoſe. "As nothing (ſays he) can be more oppoſite in principle to *fixed wards* than a lock which derives its properties from the *motion* of all its parts, I determined that the conſtruction of ſuch a lock ſhould be the ſubject of my experiment." In the proſecution of this experiment he had the ſatisfaction to find, that the leaſt perfect of all his models fully aſcertained the truth and certainty of his principle. The excluſion of wards made it neceſſary to cut off all communication between the key and the bolt; as the ſame paſſage, which (in a lock *ſimply* conſtructed) would admit the key, might give admiſſion likewiſe to other inſtruments. The office, therefore, which in other locks is performed by the extreme point of the key, is here aſſigned to a lever, which cannot approach the bolt till every part of the lock has undergone a change of poſition. The neceſſity of this change to the purpoſes of the lock, and the abſolute impoſſibility of effecting it otherwiſe than with the proper key, are the points to be aſcertained; and this our author does in the following manner.

Fig. 1. Shows Mr Bramah's firſt attempt to conſtruct a lock upon this principle: which, to his ſurpriſe, turned out complete and perfect. *A* repreſents a common axis on which the ſix levers, croſſing the Plate CCLXXII.

face

Lock.

Fig. 1.

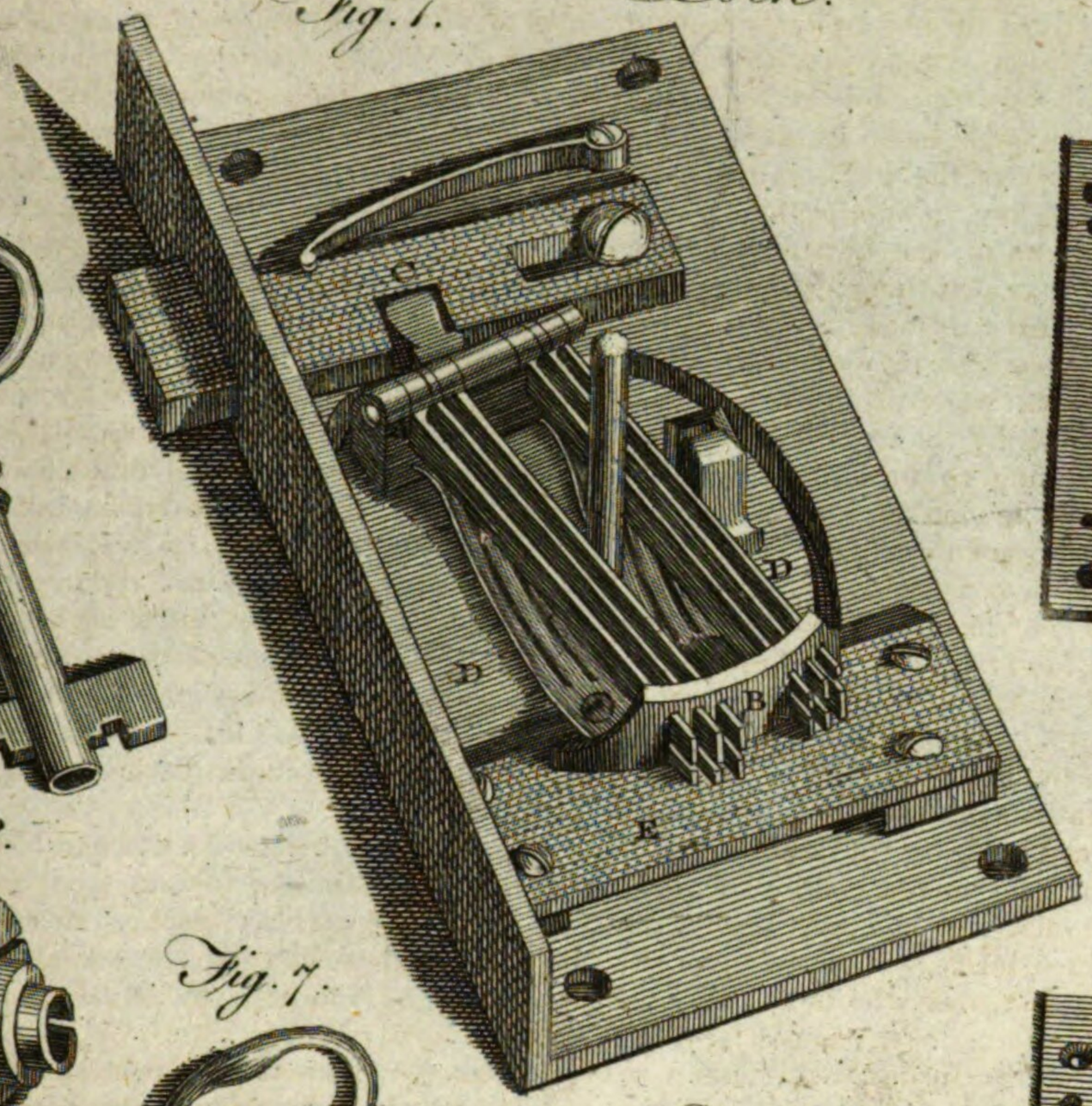


Fig. 2.

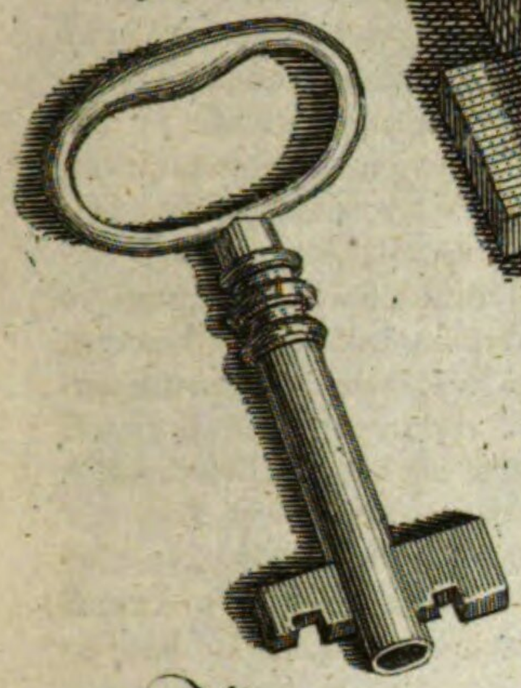


Fig. 3.

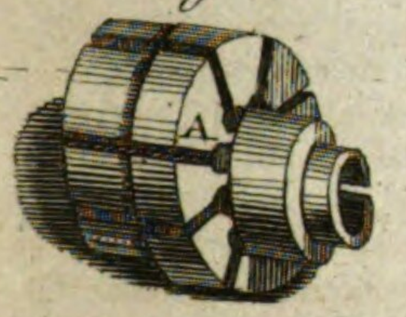


Fig. 4.

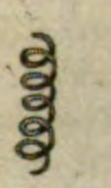


Fig. 5.

Fig. 7.

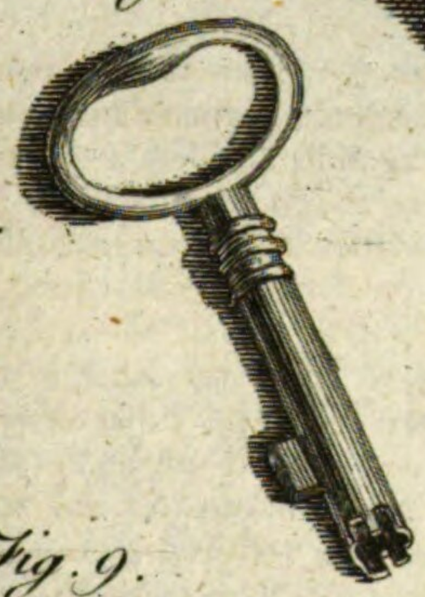


Fig. 8.

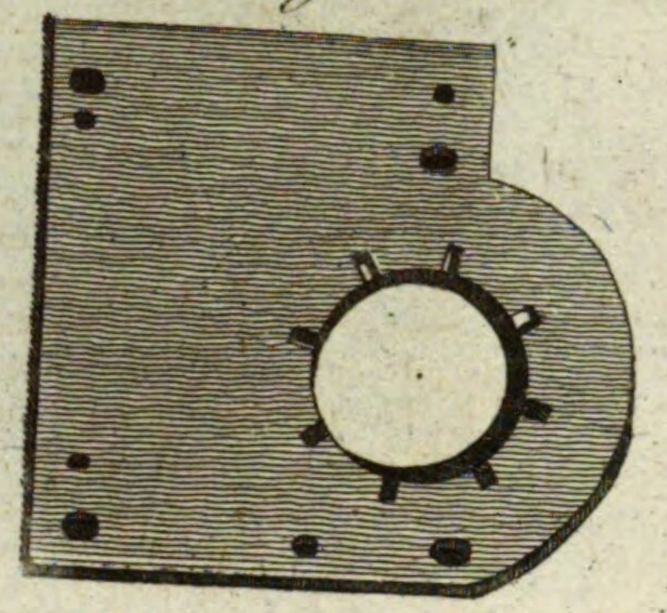


Fig. 10.

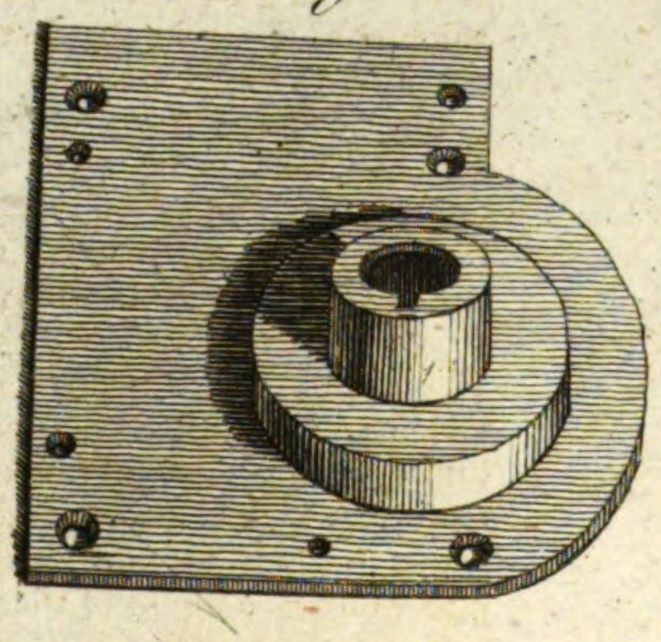


Fig. 6.

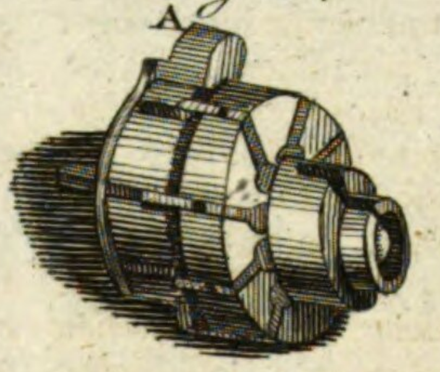
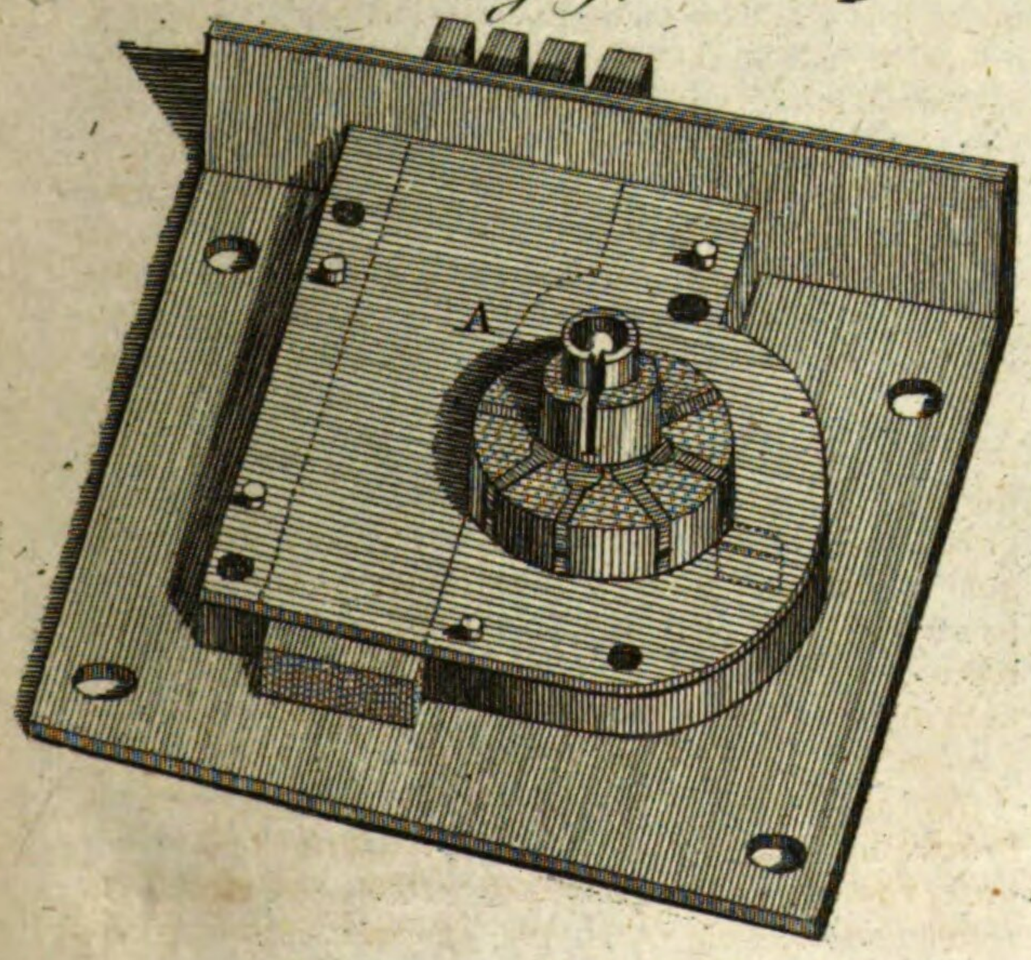
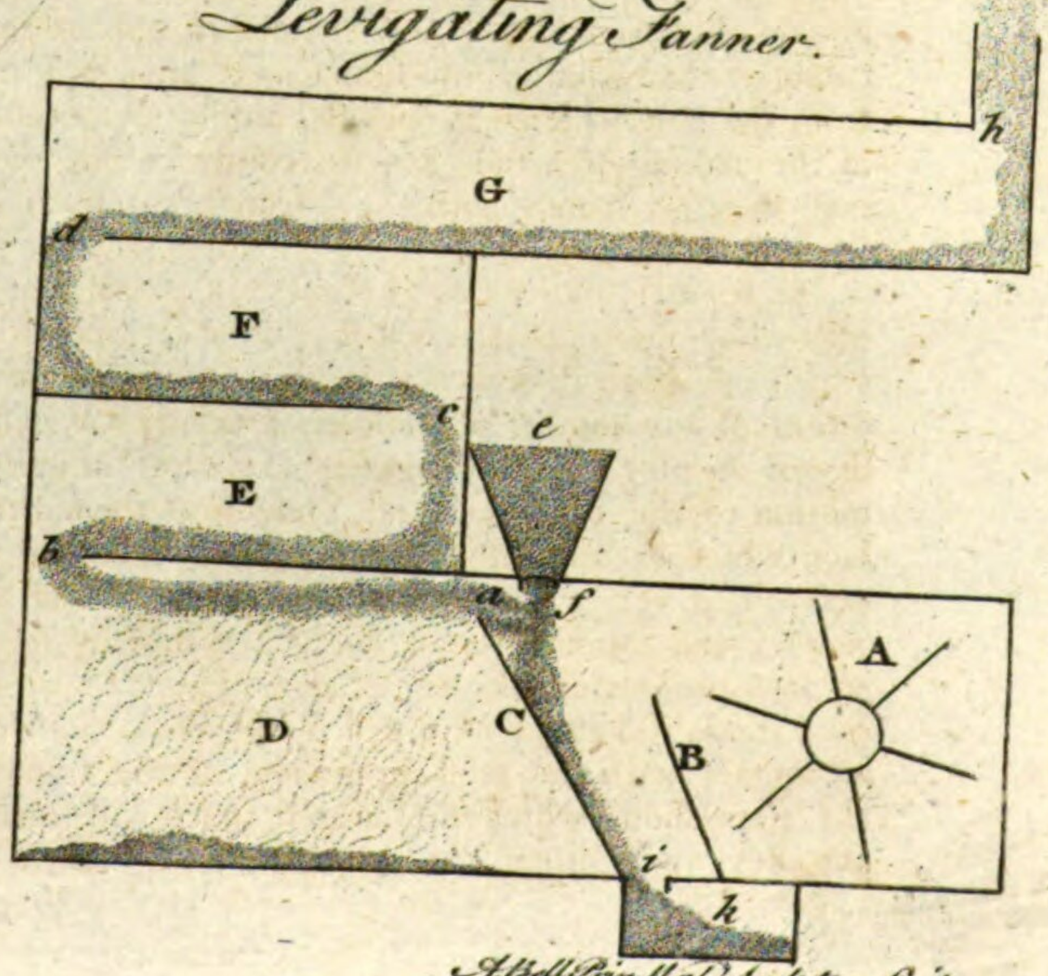


Fig. 9.



Levigating Tanner.



A. Bell Prin. Mal. Sculptor fecit.

Lock. face of the lock, are united as on a joint. Each of these rests upon a separate spring sufficiently strong to bear its weight; or, if depressed by a superior force, to restore it to its proper position when that force is removed. B represents a frame through which the levers pass by separate grooves, exactly fitted to their width, but of sufficient depth to allow them a free motion in a perpendicular direction. The part which projects from the opposite side of the joint A, and is inserted in the bolt C, is a lever to which two offices are assigned; one to keep the bolt in a fixed position, in the absence of the key; the other, to give it its proper motion upon the application of the key. D is a circular platform turning upon a centre. On this the joint or carriage of the levers, and the springs on which they rest, are fixed; and the motion of this platform impels the bolt, in either direction, by means of the lever which is projected from the joint A. The inviolable restraint upon this lock, by which means it is subjected only to the action of the key, is lodged in the part E, which is a thin plate, bearing at each extremity on a block, and having of course a vacant space beneath, equal in height to the thickness of the blocks on which it rests. By this plate the motion of the machine is checked or guided in the following manner: On the edge of the plate which faces the movement there are six notches, which receive the ends of the levers projecting beyond the frame B; and while they are confined in this manner, the motion of the machine is so totally suspended as to defy every power of art to overcome.

To understand in what manner the proper key of this lock overcomes these obstacles, it must be observed, that each lever has a notch on its extremity, and that those notches are disposed as irregularly as possible. To give the machine a capacity of motion, these notches must be brought parallel to each other, and by a distinct but unequal pressure upon the levers, be formed into a groove in a direct line with the edge of the plate E, which the notches are exactly fitted to receive. The least motion of the machine, while the levers are in this position, will introduce the edge of the plate into the groove; which, controuling the power of the springs, will give liberty to the levers to move in an horizontal direction as far as the space between the blocks which support the plate E will admit, and which is sufficient to give the machine a power of acting on the bolt. The impossibility of thus bringing the notches on the points of the levers into a direct line, so as to tally with the edge of the plate E by any other means than the motion and impulse of the key, is that which constitutes the principal excellency of this lock.

The key (fig. 2.) exhibits six different surfaces, against which the levers are progressively admitted in the operation of opening the lock: the irregularity of these surfaces shows the unequal and distinct degree of pressure which each lever requires to bring them to their proper bearings, in order to put the machine in motion. Hence it appears, that unless the various heights of the surfaces expressed on the bit of the key are exactly proportioned to the several distances necessary to bring the notches into a straight line with each other, they must remain immoveable; "and (says our author) as one stroke of a file is sufficient to cause such a disproportion as will prove an unsurmountable impediment to their motion, I may safely assert, that it is not in art to produce a key or other instrument, by which a lock, constructed upon this principle, can be opened." Lock.

On this principle it would even be a matter of great difficulty for any workman, however skilful, to construct a key for the lock when open to his inspection: "for the levers being raised, by the subjacent springs, to an equal height in the frame B, present a *plane* surface; and consequently convey no direction that can be of any use in forming a tally to the *irregular* surface which they present when acting in subjection to the key. Unless therefore we can contrive a method to bring the notches on the points of the levers in a direct line with each other, and to retain them in that position till an exact impression of the irregular surface, which the levers will then exhibit, can be taken; the workman will be unable to fit a key to the lock, or to move the bolt. This process must be rendered extremely troublesome by means of the springs; and if such difficulties occur, even when the lock is open to the inspection of a skilful workman, much more must we suppose it out of the power of one who has not access to the internal parts to make a false key to a lock of this kind.

These difficulties render it necessary in making locks of this kind not to fit the key to the lock, as is usual in other locks, but to fit the lock to the key. In this kind of lock, therefore, the key must be made first; and the inequalities upon the surface of the bit worked as chance or fancy may direct, without any reference to the lock. The key being thus completed, and applied to the surface of the levers, will, by a gentle pressure, force them to unequal distances from their common station in the frame B, and sink their points to unequal depths into the space beneath the plate E. While the levers are in this position, the edge of the plate E will mark the precise point at which the notch on each lever must be expressed. The notches being cut by this direction, the irregularity which appears when the levers resume their station in the frame B, and the inequality of the recesses on the bit of the key, will appear as a seal and its corresponding impression.

The following is a lock contrived upon the same principle, but more curious; and, in our author's opinion, more extensively useful. Fig. 3. represents a circular block of metal divided from the centre into eight compartments, each containing a cell which forms a passage through the block, as is represented by the small circles described on the flat surface A. In each of these cells two grooves are cut at opposite points, which open a communication with the centre at one point, and with the spherical surface of the block or barrel at the other. The small circle, which marks the centre of the flat surface A, is the key-hole, which likewise forms a passage through the barrel in a parallel line with the cells which surround it. This figure represents the frame in which the active parts of the lock are deposited.

Fig. 4. shows a spiral spring lodged in the bottom of each cell, and occupying one half of the space, the other being filled with a slider resting upon the spring, and represented by fig. 5. the office of these sliders ex-

Lock. actly corresponding with that of the levers in the lock already described. Thus, when lodged in their respective cells, they are sustained, like the levers, by the elasticity of the springs upon which they rest, till a superior power be applied; and they are again restored to their stations by the reaction of the springs when the weight is removed. The side B of each slider is projected beyond the circular surface, as represented fig. 6. in a manner similar to the projection of the levers in the former lock beyond the curved frame in which they move. The point C is projected through the interior groove into the space which forms the centre or key-hole, expressed on the flat surface A.

Fig. 7. represents the key. When this is applied, it must of course encounter these interior projections; and when pressed forward, the indented spaces on its point being unequal, will force the sliders to unequal distances from their bearers; bringing the notches expressed on their exterior projections in a direct line with each other, in a manner similar to that by which the effect is produced upon the levers in the former lock. When the key is withdrawn, and the sliders resume their stations by the pressure of the springs, the disposition of the notches must be irregular in the same proportion that the indentations on the point of the key are unequal; and they must necessarily fall again into a straight line when acted upon by the key.

Fig. 6. shows the barrel completely fitted for action. Its interior end is caped with a plate, which unites its compartments, and confines the springs and sliders within the cells to which they belong. From that plate proceeds the point A, which represents the lever by which the bolt is projected or withdrawn, according to the direction in which the machine performs its revolution.

Fig. 8. shows the flat surface of a thin plate, corresponding in its office with the part C of the former lock. The space cut in its centre is exactly fitted to the spherical surface of the barrel; the circle describing its circumference, and the notches cut on its edge, coinciding with the projections of the sliders. The barrel, when encircled with this plate at the middle of its spherical surface, has its motion totally suspended till the notches on the projections of the sliders are forced, by the pressure of the key, into a line with each other: a groove being thus formed on the spherical surface of the barrel parallel to, and coinciding with, the edge of the plate, the machine is at liberty to perform a revolution in any direction, but returns to its confined state when the key is withdrawn.

The parts of the movement being thus united, the interior end of the barrel is deposited in a bed represented fig. 9. To this it is fastened at the angles of the plate represented fig. 8. by which the barrel is encircled. The station of the bolt is at A; the lever which acts upon it being projected on the other side. Fig. 10. is a cap or mask which covers the face of the movement, and completes the lock.

On this lock our author observes, that it is excellent for street-doors: "for no method of robbery (says he) is more practised, than gaining admittance into houses by those keys, which, as is well known, may be procured at the old iron shops to fit almost any lock in use. Such robberies are generally committed where the servants are allowed to take the key with them when sent on errands, it being impracticable while the key is fixed in the lock. The variations, by which the production of correspondent keys is avoided, have two sources: the one arising from the changes that may be made in the disposition of the levers; the other, from the number of points contained on the projected surface of each lever; by which the position of its notch may, in the smallest degree, be varied. Lock, Locke.

"The variations, produceable in the dispositions of six figures only, are 720: these, being progressively multiplied by additional figures, will increase by astonishing degrees; and eventually show, that a lock containing twelve levers will admit of 479,001,500 changes; which, with the addition of another lever, will increase to 6,229,019,500. These being again multiplied by the number of changes which the projected surface of the levers will admit in the disposition of the notches, their amount will exceed numeration, and may therefore be properly said to be infinite. The slightest inspection will at once show, that their construction precludes all possibility of obtaining an impression of their internal parts, which is necessary for the fabrication of a false key; for it will be easily seen, that the positions into which the levers are forced by the pressure of the key in opening the lock, can no more be ascertained when the key is withdrawn, than the seal can be copied from its impression on a fluid, or the course of a ship be discovered by tracing it on the surface of the waves. But inviolable security is not the only excellence they possess: the simplicity of their principle gives them likewise a great advantage over locks that are more complicated, in point of duration; for their essential parts being subject to no friction, nor exposed to any possible accident from without, they will be less affected by use, and less liable to stand in need of repair."

Lock, or *weir*, in inland navigations, the general name for all those works of wood or stone made to confine and raise the water of a river: the banks also which are made to divert the course of a river, are called by these names in some places. But the term *lock* is more particularly appropriated to express a kind of canal inclosed between two gates; the upper called by workmen the sluice-gate, and the lower called the flood-gate. These serve in artificial navigations to confine the water, and render the passage of boats easy in passing up and down the stream. See Canal.

LOCKE (John), a most eminent English philosopher and writer in the latter end of the 17th century, was son of Mr John Locke of Pensford in Somersetshire, and born at Wrington near Bristol in 1632. He was sent to Christ-church in Oxford; but was highly dissatisfied with the common course of studies then pursued in the university, where nothing was taught but the Aristotelian philosophy; and had a great aversion to the disputes of the schools then in use. The first books which gave him a relish for philosophy, were the writings of Des Cartes: for though he did not always approve of his notions, yet he thought he wrote with great perspicuity. He applied himself with vigour to his studies, particularly to physic, in which he gained a considerable knowledge, though he never practised it. In 1694, he went to Germany as secretary to Sir William Swan, envoy from the English court to the elector of Brandenburg and some other

Locke. other German princes. In leſs than a year, he returned to England; where, among other ſtudies, he applied himſelf to that of natural philoſophy, as appears from a regiſter of the changes of the air, which he kept at Oxford from June 24. 1666, to March 28. 1667. There he became acquainted with the lord Aſhly, afterwards earl of Shafteſbury, who introduced him into the converſation of ſome of the moſt eminent perſons of that time. In 1670, he began to form the plan of his *Eſſay on Human Underſtanding*; but his employments and avocations prevented him from finiſhing it then. About this time he became a member of the Royal Society. In 1672, his patron, now earl of Shafteſbury, and lord chancellor of England, appointed him ſecretary of the preſentations, which place he held till the earl reſigned the great ſeal. In 1673, he was made ſecretary to a commiſſion of trade, worth 500 l. a-year; but that commiſſion was diſſolved in 1674. The earl of Shafteſbury being reſtored to favour, and made preſident of the council in 1679, ſent for Mr Locke to London: but that nobleman did not continue long in his poſt, being ſent priſoner to the tower; and after his diſcharge retired to Holland in 1682.

Mr Locke followed his patron thither. He had not been abſent from England a year, when he was accuſed at court of having written certain tracts againſt the government, which were afterward diſcovered to be written by another perſon; and in November 1684, he was deprived of his place of ſtudent in Chriſt-church. In 1685, the Engliſh envoy at the Hague demanded him and 83 other perſons to be delivered up by the States General: upon which he lay concealed till the year following; and during this time formed a weekly aſſembly with Mr Limborch, Mr Le Clerc, and other learned men at Amſterdam. In 1689 he returned to England in the fleet which conveyed the princeſs of Orange; and endeavoured to procure his reſtoration to his place of ſtudent of Chriſt-church, that it might appear from thence that he had been unjuſtly deprived of it: but when he found the college would admit him only as a ſupernumerary ſtudent, he deſiſted from his claim.

Being eſteemed a ſufferer for revolution-principles, he might eaſily have obtained a more profitable poſt; but he contented himſelf with that of commiſſioner of appeals, worth 200 l. a year, which was procured for him by the Lord Mordaunt, afterwards earl of Monmouth, and next of Peterborough. About the ſame time he was offered to go abroad in a public character; and it was left to his choice, whether he would be envoy at the court of the emperor, that of the elector of Brandenburg, or any other where he thought the air moſt ſuitable to him: but he waved all theſe, on account of the infirm ſtate of his health; which diſpoſed him gladly to accept another offer that was made by Sir Francis Maſham and his lady, of an apartment in their country-ſeat at Oates in Eſſex, about 25 miles from London.

This place proved ſo agreeable to him in every reſpect, that it is no wonder he ſpent the greateſt part of the remainder of his life at it. The air reſtored him almoſt to a miracle, in a few hours after his return at any time from the town, quite ſpent and unable to ſupport himſelf. Beſides this happineſs here, he found in lady Maſham a friend and companion exactly to his heart's wiſh; a lady of a contemplative and ſtudious complexion, and particularly inured, from her infancy, to deep and refined ſpeculations in theology, metaphyſics, and morality. In this family Mr Locke lived with as much eaſe as if the whole houſe had been his own: and he had the additional ſatisfaction of ſeeing this lady breed up her only ſon exactly upon the plan which he had laid down for the beſt method of education; the ſucceſs of which was ſuch as ſeemed to give a ſanction to his judgment in the choice of that method. In effect, it is to the advantage of this ſituation that he derived ſo much ſtrength as to continue exerting thoſe talents which the earl of Shafteſbury had obſerved to be in him for political ſubjects. Hence we find him writing in defence of the revolution in one piece; and conſidering the great national concern at that time, the ill ſtate of the ſilver coin, and propoſing remedies for it, in others. Hence he was made a commiſſioner of trade and plantations in 1695, which engaged him in the immediate buſineſs of the ſtate; and with regard to the church, he publiſhed a treatiſe the ſame year, to promote the ſcheme which king William had much at heart, of a comprehenſion with the diſſenters. This, however, drew him into one controverſy; which was ſcarcely ended, when he entered into another in defence of his eſſay, which held till 1698: ſoon after which the aſthma, his conſtitutional diſorder, increaſing with his years, began to ſubdue him; and he became ſo infirm, that in 1700 he reſigned his ſeat at the board of trade, becauſe he could no longer bear the air of London ſufficient for a regular attendance upon it. After this reſignation he continued altogether at Oates; in which retirement he employed the remaining laſt years of his life entirely in the ſtudy of the holy Scriptures. Locke || Locle.

He died in 1704, aged 73. His writings will immortalize his name. The earl of Shafteſbury, author of the Characteriſtics, though in one place he ſpeaks of Mr Locke's philoſophy with ſeverity; yet obſerves, concerning his Eſſay on the Human Underſtanding, in general, "that it may qualify men as well for buſineſs and the world, as for the ſciences and the univerſity." Whoever is acquainted with the barbarous ſtate of the philoſophy of the human mind, when Mr Locke undertook to pave the way to a clear notion of knowledge, and the proper methods of purſuing and advancing it, will be ſurpriſed at this great man's abilities; and plainly diſcover how much we are beholden to him for any conſiderable improvements that have been made ſince. His Diſcourſes on Government, Letters on Toleration, and his Commentaries on ſome of St Paul's Epiſtles, are juſtly held in the higheſt eſteem.

LOCKED JAW. See (the *Index* ſubjoined to) MEDICINE.

LOCKMAN, an officer in the Iſle of Man, who executes the orders of government, much like our under-ſheriff.

LOCKMAN, an eaſtern philoſopher. See LOKMAN.

LOCLE, a ſmall town in a diſtrict of the ſame name in Switzerland, adjacent to Neufchatel and Vallengin, and united with another named *La Ghaux de Fond*. Both theſe diſtricts occupy ſome valleys formed by the mountains of Jura; the greateſt part of

Locle, Locri.

which not many years ago was one continued foreſt, though now converted into fine paſture-ground fitted with flouriſhing villages. The increaſe of population in theſe diſtricts is particularly evident from the following circumſtance, *viz.* that formerly the produce of the country was more than ſufficient to ſerve the inhabitants; but now, though conſiderably better cultivated, it ſcarce furniſhes an eighth part of the neceſſary conſumption. This great increaſe of numbers is owing to the early marriages of the inhabitants; to the liberty allowed to every ſtranger, who brings a certificate of his good behaviour, to ſettle in the diſtrict; to follow any trade without reſtriction, and without an apprenticeſhip; and to the want of taxes, and an unbounded freedom of commerce. The induſtry and genius of the people in theſe diſtricts is very ſurpriſing. They carry on an extenſive commerce in lace, ſtockings, cutlery, and other merchandiſe of their own manufacture; and particularly excel in every branch of watch and clock making. They make all the utenſils neceſſary in theſe arts, and have invented ſeveral new ones. There are alſo in theſe diſtricts painters, gilders, enamellers, engravers, and other artiſts neceſſary for completing the buſineſs of watch making; by which means that buſineſs is carried on to ſo great an extent, that 40,000 watches are computed to be annually made. Beſides theſe arts already mentioned, the people are extremely ingenious in other branches of mechanics, and have invented ſeveral aſtronomical and mathematical inſtruments. One of the moſt eminent in this way is Jaquet Droz, now at Paris; and whoſe ſon exhibited ſeveral ſurpriſing automatical figures in England. One of theſe played upon a harpſichord; another drew landſcapes; and a third copied any word preſented to it, or wrote down whatever was dictated by any of the company.

The inhabitants of theſe diſtricts are very courteous to ſtrangers who viſit them: they are in general well informed in ſeveral branches of knowledge; and as they commonly employ their leiſure hours in reading, they have circulating libraries in many of their villages. Their houſes are plaſtered, white waſhed, well built, and commodious, though ſmall; being beſides furniſhed with a degree of neatneſs and even elegance peculiarly ſtriking in theſe ſequeſtered mountains. "Such perfect eaſe and plenty (ſays Mr Coxe) reigns throughout theſe mountains, that I ſcarcely ſaw one object of poverty: the natural effects of induſtry under a mild and equitable government."

LOCRI, or *Locri Epizephyrii*, (anc. geog.), a town of the Bruttii, on the Ionian ſea: a colony of the Locri Ozolæ (Strabo); rather of the Epicnemidii (Virgil), who calls it *Narycii Locri*, from Naryx a town of the Locri Epicnemedii. The epithet *Epizephyrii* is from its ſituation near the promontory Zephyrium (Strabo); *Locri* and *Locrenſes*, the people. They are ſaid to be the firſt who uſed a code or body of written laws, compiled by Zaleucus from the laws of the Cretans, Lacedemonians, and the Areopagitæ, adding an expreſs penalty to each law, which was before diſcretionary, at the option of the judge (Strabo). Adultery was puniſhed with the loſs of both eyes. His own ſon being convicted of this crime; to maintain at the ſame time the authority of the law, and to pay ſome regard to the interceſſion of the people in favour of his ſon, Zaleucus ſuffered the loſs of an eye, his ſon loſing another (Ælian, Val. Maximus.)

Locris. || Log.

LOCRIS, the diſtrict or territory of Locri in the Bruttii in Italy.

Locris, a country of Achaia in Greece; twofold, and divided by mount Parnaſſus. The Hither was occupied by the Locri Ozolæ, called alſo *Zephyrii*, or Weſtern, contained between Ætolia and Phocis, beginning at Naupactum, and running in a narrow ſlip of land, ſcarce 200 ſtadia, along the ſea to the borders of the Phocenſes. The Farther Locris lay beyond Parnaſſus, running out towards Thermopylæ, and reaching to the Euripus of Eubœa; occupied by the Locri Opuntii, who dwelt on the Eubœan ſea; and the Epicnemidii, who occupied mount Cnemis (Strabo); and theſe two were the Eaſtern Locri.

LOCUS geometricus, denotes a line by which a local or indeterminate problem is ſolved.

A *locus* is a line, any point of which may equally ſolve an indeterminate problem. Thus if a right line ſuffice for the conſtruction of the equation, it is called *locus ad rectum;* if a circle, *locus ad circulum;* if a parabola, *locus ad parabolam;* if an ellipſis, *locus ad ellipſin:* and ſo of the reſt of the conic ſections.

LOCULAMENTA, and Loculi, in botany; cells or pockets: The internal diviſions of a capſule, or other dry ſeed-veſſel, ſo termed.—Theſe cells contain or incloſe the ſeeds; and are different in number in different plants.

The term Loculus is alſo ſometimes uſed to expreſs the minute diviſions in ſome ſpecies of *antheræ*, which contain the fine impalpable powder ſuppoſed by the ſexualiſts to be the principal agent in the generation of plants.

LOCUST, in zoology. See Gryllus.

Locust-Eaters. See Acridophagi.

American Locust, or *Frog-hopper.* See Cicada.

Locust-Tree. See Hymenæa and Gleditsia.

LOCUTIUS, in mythology, the god of ſpeech among the Romans, called by Livy *Aius Locutius*.

LOCUTORIUM. The monks and other religious in monaſteries, after they had dined in their common hall, had a withdrawing-room, where they met and talked together among themſelves, which room, for that ſociable uſe and converſation, they called *locutorium, a loquendo*; as we call ſuch a place in our houſes parlour, from the French *parler;* and they had another room, which was called *locutorium forinſecum*, where they might talk with laymen.

LODGMENT, in military affairs, a work made by the beſiegers in ſome part of a fortification (after the beſieged have been driven out), to maintain it, and be covered from the enemy's fire.—When a lodgement is to be made on the glacis, covert-way, or in a breach, there muſt be a great proviſion made of faſcines, ſand-bags, gabions, wool-packs, &c. in the trenches; and during the action, the pioneers, under the direction of an engineer, with faſcines, ſand-bags, &c. ſhould be making the lodgment, in order to form a covering, while the grenadiers are ſtorming the covert-way.

LODE, in mining. See Load.

LOG, in the Jewiſh antiquities, a meaſure which held a quarter of a cab, and conſequently five-ſixths of a pint. There is mention of a log, 2 Kings vi. 25.

under

Log.

Fig. 1.

Fig. 2.

Fig. 3.

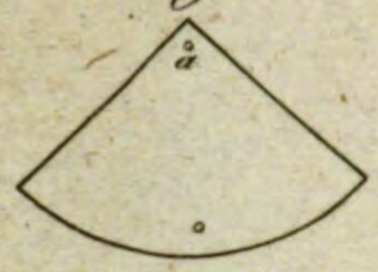


Fig. 4.

Logarithms.

Fig. 1.

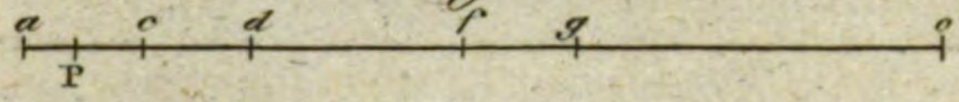


Fig. 2.

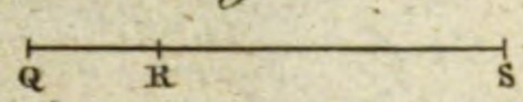


Fig. 3.

Fig. 4.

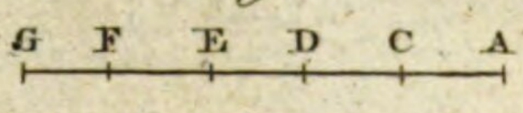


Fig. 5.

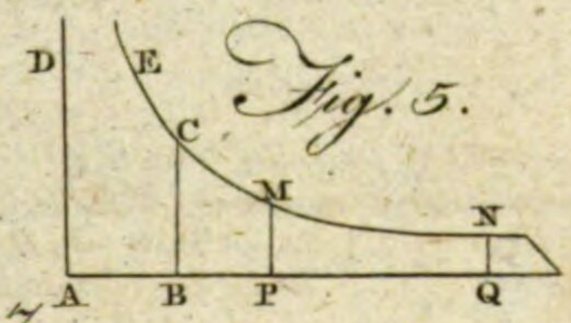


Fig. 6.

Fig. 7.

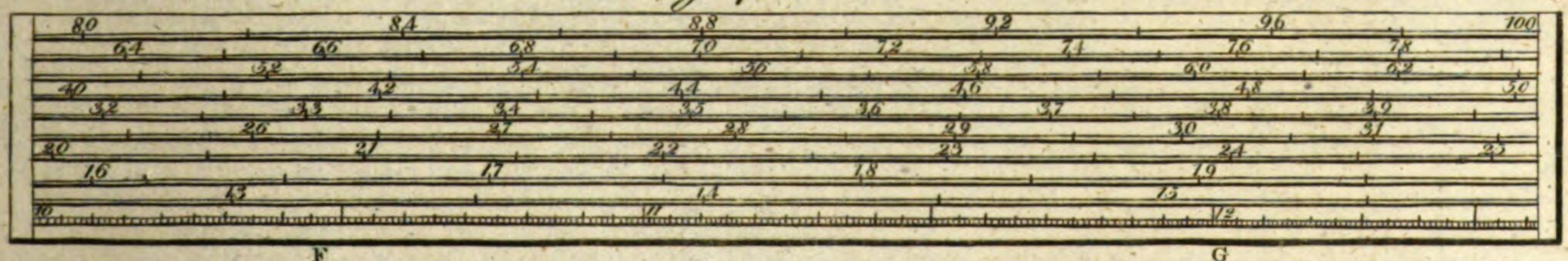


Fig. 8.

Fig. 9.

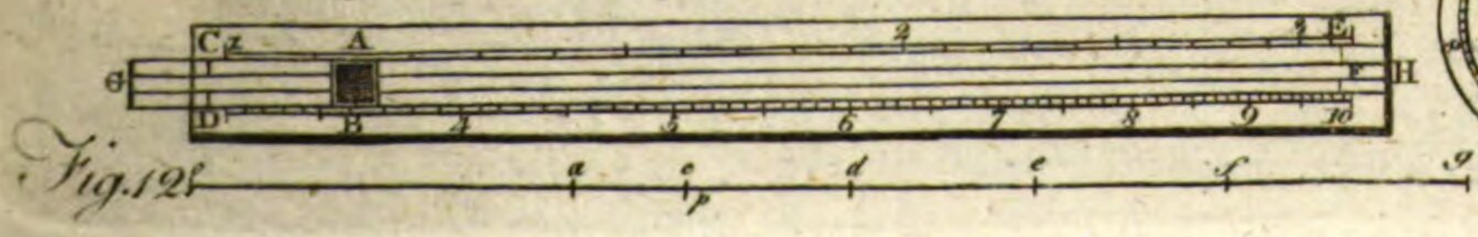


Fig. 12.

Fig. 10.

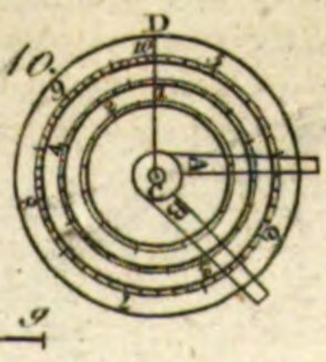
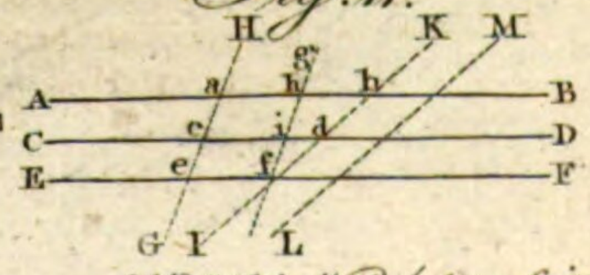


Fig. 11.



A. Bell Prin. Wal. Sculptor fecit.

Log. under the name of a *fourth part of a cab*. But in Leviticus the word log is often met with, and ſignifies that meaſure of oil which lepers were to offer at the temple after they were cured of their diſeaſe. Dr Arbuthnot ſays, that the log was a meaſure of liquids, the ſeventy-ſecond part of the bath or ephah, and twelfth part of the hin, according to all the accounts of the Jewiſh writers.

Plate CCLXXIII fig. 3. LOG, a ſea term, ſignifying a ſmall piece of timber *a*, of a triangular, ſectoral, or quadrantal figure, on board a ſhip, generally about a quarter of an inch thick, and five or ſix inches from the angular point to the circumference. It is balanced by a thin plate of lead, nailed upon the arch, or circular ſide, ſo as to ſwim perpendicularly in the water, with about two thirds immerſed under the ſurface.

Log-Line, a little cord, or line, about a hundred and fifty fathoms long, faſtened to the log by means of two legs *ab* (fig. 4.), one of which paſſes through a hole at the corner, and is knotted on the oppoſite ſide, while the other leg is attached to the arch by a pin fixed into another hole, ſo as to draw out occaſionally. By theſe legs the log is hung in equilibrio; and the line thus annexed to it is wound round a reel fixed for that purpoſe in the gallery of the ſhip.

This line, from the diſtance of about ten, twelve, or fifteen fathoms off the log, has certain knots or diviſions, which ought to be at leaſt fifty feet from each other; though it was the common practice at ſea not to have them above forty-two feet aſunder.

The length of each knot ought to be the ſame part of a ſea-mile as half a minute is of an hour; and admitting the meaſurement of Mr Norwood, who makes a degree on a great circle of the earth to contain 367,200 Engliſh feet, or about $69\frac{1}{2}$ Engliſh ſtatute miles, and, therefore, $\frac{1}{60}$th part of it, or a nautical mile, will be 6120 feet; $\frac{1}{120}$th of 6120, or 51 feet, ſhould be the length of each knot. But becauſe it is ſafer to have the reckoning rather before the ſhip than after it, therefore fifty feet may be taken as the proper length of each knot. The knots are ſometimes made to conſiſt only of forty-two feet each, even in the preſent practice; and this method of dividing the log-line was founded on the ſuppoſition that ſixty miles, each of 5000 Engliſh feet, made a degree; for $\frac{1}{120}$ of 5000 is $41\frac{2}{3}$, or, in round numbers, 42 feet. Mariners, rather than quit the old way, though known to be erroneous, uſe glaſſes for half minute ones, that run but 24 or 25 ſeconds. They have alſo uſed a line of 45 feet to 30 ſeconds, or a glaſs of 28 ſeconds to 42 feet. When this is the caſe, the diſtance between the knots ſhould be corrected by the following proportion: as 30 is to 50; ſo is the number of ſeconds of the glaſs to the diſtance between the knots upon the line. The heat or moiſture of the weather has often a conſiderable effect upon the glaſs, ſo as to make it run ſlower or faſter; it ſhould, therefore, be frequently tried by the pendulum in the following manner. On a round nail hang a ſtring that has a muſket-ball fixed to one end, carefully meaſuring between the centre of the ball and the ſtring's loop over the peg $39\frac{1}{8}$ inches, being the length of a ſecond pendulum; then ſwing it, and count one for every time it paſſes under the peg, beginning at the ſecond time it paſſes; and the number of ſwings made during the time the glaſs is running out ſhows the ſeconds it contains. The line alſo is liable to relax and ſhrink, and ſhould therefore be occaſionally meaſured. Log.

The uſe of the log and line is to keep account and make an eſtimate of the ſhip's way or diſtance run; which is done by obſerving the length of line unwound in half a minute's time, told by a half-minute glaſs; for ſo many knots as run out in that time, ſo many miles the ſhip ſails in an hour. Thus, if there be four knots veered out in half a minute, the ſhip is computed to run four miles an hour.

The author of this device for meaſuring the ſhip's way is not known; and no mention of it occurs till the year 1607, in an Eaſt-India voyage publiſhed by Purchas; but from that time its name occurs in other voyages among his collections; and henceforward it became famous, being taken notice of both by our own authors and by foreigners; as by Gunter in 1623; Snellius in 1624; Metius in 1631; Oughtred in 1633; Herigone in 1634; Saltonſtall in 1636; Norwood in 1637; Pournier in 1643; and almoſt by all the ſucceeding writers on navigation of every country.

To Heave the Log, as they call it, they throw it into the water on the lee-ſide, letting it run till it comes without the eddy of the ſhip's wake; then one, holding a half-minute glaſs, turns it up juſt as the firſt knot, or the mark from which the knots begin to be reckoned, turns off the reel (fig. 2.) or paſſes over the ſtern. As ſoon as the glaſs is out, the reel is ſtopped, and the knots run off are told, and their parts eſtimated.

It is uſual to heave the log once every hour in ſhips of war and Eaſt-India men, and in all other veſſels once in two hours; and if at any time of the watch the wind has increaſed or abated in the intervals, ſo as to affect the ſhip's velocity, the officer generally makes a ſuitable allowance for it at the cloſe of the watch.

The log is a very precarious way of computing, and muſt always be corrected by experience and good ſenſe; there being a great deal of uncertainty in the yawing of the ſhip going with the wind aft, or upon the quarter in the heaving of it, by its coming home, or being drawn after the ſhip, on account of the friction of the reel and lightneſs of the log in the courſe of the current, and in the ſtrength of the wind, which ſeldom keeps the ſame tenor for two hours together; which is the interval between the times of uſing the log in ſhort voyages, though in longer ones they heave it every hour. Yet this is a much more exact way of computing than any other in uſe; much preferable certainly to that of the Spaniards and Portugueſe, who gueſſed at the ſhip's way by the running of the froth or water by the ſhip's ſide; or to that of the Dutch, who uſed to heave a chip over-board, and to number the paces they walk on the deck while the chip ſwims between any two marks, or bulk-heads on the ſide.

Compound Log. The above mentioned errors, and particularly the log's being ſubject to drive with the motion which the water may have at its ſurface, whereas the experiment requires it to be fixed in the place where it is when the mark commencing the knots goes off the reel, have been conſidered by writers, and many methods have been propoſed to remove, or at leaſt to leſſen them.

Log. The late M. Bouguer propoſed a method, which has been thought deſerving of particular attention, in the Mem. Acad. Sc. 1747; afterwards in his Treatiſe on Navigation, publiſhed at Paris in 1753, and ſince reprinted in 1760, by the abbé de la Caille. For this purpoſe, take for the log a conical piece of wood, which fix to the log-line paſſed through or along its axis, at about 40, 50, or 60, or more feet, from one end; and to this end fix the diver, which is a body formed of two equal ſquare pieces of tin, or of thin iron plate, fixed at right angles to one another along their diagonals; and its ſize ſo fitted to that of the cone, that the whole may float. A cone of three inches diameter in the baſe, and of ſix inches in the ſlant height, is propoſed by M. Bouguer to ſuit a diver made of plates about $9\frac{1}{4}$ inches ſquare; the interſection of the diagonals is joined to the log-line, and the loop and peg fixed as in the common log. However, it has been found, that no kind of wood uſed in Britiſh dock-yards, when formed into a cone of the above dimenſions, will float a diver made of ſtout tin plates, one ſide of the ſquare being $9\frac{1}{4}$ inches. Such a diver weighing $1\frac{7}{8}$lb avoirdupoiſe, required to float it a cone of five inches diameter and twelve inches on the ſlant ſide, ſo as the point of the cone, which was made of light fir, ſhould juſt appear above the water. Now ſuppoſing one ſide of ſuch a ſquare tin-diver to be about ten inches, and made of plates only two-thirds of the thickneſs of the former, ſuch a diver would weigh, with its ſolder, about 20 ounces, and can be floated by a light fir cone of four inches diameter in the baſe, and ten inches in the ſlant height or length; and ſuch a compound log might perhaps be found on trial to be affected by about as much again as that propoſed by M. Bouguer; and conſequently the difference between the numbers given by the common log and compound log, muſt be augmented by two-thirds of itſelf for the neceſſary correction, as below. When the compound log of Bouguer, above deſcribed, is hove overboard, the diver will ſink too deep to be much affected by the current or motion of water at the ſurface, and the log will thereby keep more ſteadily in the place where it firſt fell; and conſequently the knots run off the reel will ſhow more accurately the ſhip's rate of ſailing. As the common log is affected by the whole motion of the current, ſo this compound log will feel only a part thereof, viz. ſuch a part nearly as the reſiſtance of the cone is to the reſiſtance of the diver; then the reſiſtances of the above cone and diver are about as 1 to 5; and conſequently this log will drive but one-fifth part of what the common log would do; and ſo the ſhip's true run will be affected by one-fifth only of the motion of the waters. To obtain the true rate of ſailing, it will be proper to heave alternately, hour and hour, the common log and this compound log; then the difference of their knots run off, augmented by its one-fourth part, is the correction; which applied to the knots of the common log, will give the ſhip's true rate of ſailing at the middle time between the hours when theſe logs were hove. The correction is additive when the compound log's run is the greateſt, otherwiſe it is ſubtractive. To find the courſe made good: increaſe the obſerved angle between the log-lines by one fourth-part; and this gives the correction to be applied to the apparent courſe, or the oppoſite of that ſhown by the common log; the correction is to be applied to the $\left\{\begin{matrix}\text{right}\\\text{left}\end{matrix}\right\}$ of the apparent courſe, when the bearing of the common log is to the $\left\{\begin{matrix}\text{left}\\\text{right}\end{matrix}\right\}$ of the compound log. Or thus: the lengths run off both logs, together with their bearings, being known; in a card or compaſs apply the knots run off, taken from a ſcale of equal parts along their reſpective bearings, from the centre; join the ends; and in this line produced, on the ſide next the compound log's length, take one-fourth of the interval; then a line drawn from the end, thus produced, to the centre of the card, will ſhow the true courſe and diſtance made good. When a current, ſuch as a tide, runs to any depth, the velocity of that current may be much better aſcertained by the compound log than by the common one, provided the diver does not deſcend lower than the run of the current; for as thoſe ſhips which are deepeſt immerged, drive faſteſt with the tide; ſo the diver, by being acted on below, as well as the log on the ſurface, their joint motion will give the total effect of the current's motion better than what could be derived from the motion at the ſurface only. Alſo, by ſuch a compound log, the depth to which any current runs may be eaſily tried. Log.

Other Logs. We have an account in the voyage to the North Pole, p. 97. of two other logs, which were tried by captain Phipps: one invented by Mr Ruſſel, the other by Foxon; both conſtructed upon this principle, that a ſpiral, in proceeding its own length in the direction of its axis through a reſiſting medium, makes one revolution round the axis; if, therefore, the revolutions of the ſpiral are regiſtered, the number of times it has gone its own length through the water will be known. In both theſe the motion of the ſpiral in the water is communicated to the clock-work within-board, by means of a ſmall line faſtened at one end to the ſpiral, which tows it after the ſhip, and at the other to a ſpindle, which ſets the clock-work in motion. That invented by Mr Ruſſel has a half-ſpiral of two threads, made of copper, and a ſmall dial with clock-work, to regiſter the number of turns of the ſpiral. The other log has a whole ſpiral of wood with one thread, and a larger piece of clock-work with three dials, two of them to mark the diſtance, and the other divided into knots and fathoms, to ſhow the rate by the half-minute glaſs, for the convenience of comparing it with the log. This kind of log will have the advantage of every other in ſmooth water and moderate weather; and it will be uſeful in finding the trim of a ſhip when alone, in ſurveying a coaſt in a ſingle ſhip, or in meaſuring diſtances in a boat between head-lands and ſhoals; but it is ſubject to other inconveniences, which will not render it a proper ſubſtitute for the common log.

Perpetual Log, a machine ſo called by its inventor, Mr Gottlieb of Houndſditch, London. It is intended by it to keep a conſtant and regular account of the rate of the ſhip's velocity through the water; whereas the common log hitherto uſed does not indicate the variation in her velocity in the interval of heaving the log, and conſequently does not aſcertain the true diſtance that the ſhip has run in any given length of time.

Fig.

Log. Fig. 1. is a repreſentation of the whole machine; the lower part of which, EFG, is fixed to the ſide of the keel; H repreſenting only the boundary line of the ſhip's figure. EF are the ſection of a wooden external caſe, left open at the ends KL, to admit the paſſage of the water during the motion of the ſhip. At M is a copper grating, placed to obſtruct the entrance of any dirt, &c. into the machine. I, is a ſection of a water-wheel, made from 6 to 12 inches in diameter, as may be neceſſary, with float-boards upon its circumference, like a common water-wheel, that turn by the reſiſtance of the water paſſing through the channel LK. It turns upon a ſhouldered axis, repreſented by the vertical ſection at K. When the ſhip is in motion, the reſiſtance of the water through the channel LK turns round the wheel I. This wheel, by means of a pinion, is connected with and turns the rod contained in the long copper tube N. This rod, by a pinion fixed at its upper extremity, is connected with and turns upon the whole ſyſtem of wheels contained in the dial of the caſe ABCD. This dial, by means of the copper tube N, may be fixed to any convenient place aboard the ſhip. In the front of the dial are ſeveral uſeful circular graduations, as follow: The reference by the dotted line A has an hand which is moved by the wheels within, which points out the motion of the ſhip in fathoms of 6 feet each. The circle at B has an hand ſhowing the knots, at the rate of 48 feet for each knot; and is to be obſerved with the half-minute glaſs at any time. The circle at C has a ſhort and a long hand; the former of which points out the miles in land-meaſure, and the latter or longer the number of knots contained in each mile, viz. 128, which is in the ſame proportion to a mile as 60 minutes to the hour in the reckoning. At *e*, a ſmall portion of a circle is ſeen through the front-plate called the *regiſter*; which ſhows, in the courſe of 24 hours (if the ſhip is upon one tack), the diſtance in miles that ſhe has run; and in the 24 hours the mariner need take but one obſervation, as this regiſter ſerves as an uſeful check upon the fathoms, knots, and miles, ſhown upon the two other circles.

Plate CCLXXIII

f, Is a plate ſhowing 100 degrees or 6000 miles, and alſo acts as another regiſter or check; and is uſeful in caſe of any miſtake being made in obſerving the diſtance run by the other circles. The reckoning by theſe circles, without fear of miſtake, may therefore be continued to nearly 12,000 miles.

A communication from this machine may eaſily be made to the captain's bed-ſide, where by touching a ſpring only, a bell in the head ABCD will ſound as many times in an half minute as the ſhip ſails miles in an hour.

Mr Gottlieb has applied this machine to the Carteret and Weſtmoreland packets. He is very ſanguine in the hopes of its ſucceſs and utility; and conceives that the mariner will, by this contrivance, be better enabled than heretofore to keep the veſſel and his reckoning together; it being well known that the moſt experienced navigator is too frequently erroneous in this reſpect, the ſhip being ſometimes a-head, or ſometimes aſtern, off the reckoning.

He alſo obſerves, that the conſtruction of the log is ſuch, that if the veſſel was to be aground, ſtrike a rock, or ſtrip off her falſe keel, the parts would not be deranged: and further, ſhould ſhe be laid up for repairs, &c. ſix months, in half an hour after coming again into the water, the lower immerged part of the log would clear itſelf, and be in proper action.

Log-Board, a ſort of table, divided into ſeveral columns, containing the hours of the day and night, the direction of the winds, the courſe of the ſhip, and all the material occurrences that happen during the 24 hours, or from noon to noon; together with the latitude by obſervation. From this table the different officers of the ſhip are furniſhed with materials to compile their journals, wherein they likewiſe inſert whatever may have been omitted, or reject what may appear ſuperfluous in the log-board.

Log-Book, a book into which the contents of the log-board is daily copied at noon, together with every circumſtance deſerving notice that may happen to the ſhip, or within her cognizance, either at ſea or in a harbour, &c. The intermediate diviſions or watches of the log-book, containing four hours each, are uſually ſigned by the commanding officer in ſhips of war or Eaſt-Indiamen. See NAVIGATION.

LOGARITHMS.

LOGARITHMS, (from λογος *ratio*, and αριθμος *number*), the indices of the ratios of numbers to one another; being a ſeries of numbers in arithmetical progreſſion, correſponding to others in geometrical progreſſion; by means of which, arithmetical calculations can be made with much more eaſe and expedition than otherwiſe.

SECT. I. *Hiſtory of Logarithms.*

THE invention of logarithms firſt occurred to thoſe verſant in the conſtruction of trigonometrical tables, in which immenſe labour was required by large multiplications, diviſions, and extraction of roots. The aim propoſed was, to reduce as much as poſſible the multiplications and diviſions to additions and ſubtractions: and for this purpoſe, a method was invented by Nicholas Raymer Urſus Dithmarſus, which ſerves for one caſe of the ſines, viz. when the radius is the firſt term in proportion, and the ſines of two arcs the ſecond and third terms. In this caſe the fourth term is found by only taking half the ſum or difference of the ſines of the other two arcs, and the complement of the greater. This method was firſt publiſhed in 1588, and a few years afterward was greatly improved by Clavius, who uſed it in all proportions in the ſolution of ſpherical triangles; adapting it to ſines, tangents, verſed ſines, and ſecants; and this, whether the radius was the firſt term in the proportion or not.

This method, however, though now become much more

more generally uſeful than before, was ſtill found attended with trouble in ſome caſes; and as it depended upon certain properties of lines belonging to the circle, was rather of a geometrical than arithmetical nature; on which account the calculators about the end of the 16th and beginning of the 17th century, finding the ſolution of aſtronomical problems extremely troubleſome, by reaſon of the tedious multiplications and diviſions they required, continued their endeavours to leſſen that labour, by ſearching for a method of reducing their operations to addition and ſubtraction. The firſt ſtep towards this was, the conſideration, that as in multiplication the ratio of the multiplier to unity is the ſame as that of the product to the multiplicand, it will follow, that the ratio of the product to unity muſt be equal to the ſum of the two ratios of the multiplier to unity, and of the multiplicand to unity. Could a ſet of numbers therefore be found, which would repreſent the ratios of all other numbers to unity, the addition of two of the former ſet of numbers would be equivalent to the multiplication of the two numbers together, the ratios of which they denoted; and the ſum ariſing from this addition would denote the ratio of their product to unity; whence the product itſelf might be found by looking for the correſponding natural number in the table.

The next thing was to fall upon a method of calculating ſuch a table as was wanted, which indeed appeared an Herculean labour. The firſt obſervation was, that whatever numbers might be made uſe of to repreſent the ratios of others, the ratio of equality, or that of unity to unity muſt be 0; for that ratio has properly no magnitude, neither increaſing nor diminiſhing any other ratio to which it is adapted, or from which it is ſubtracted.

2. The ſecond obſervation was, that though any number might be choſen at pleaſure to repreſent the ratio of any other number to unity, yet when once this choice was made, all the other numbers repreſenting the different ratios muſt be determined by it. Thus, if the ratio of 10 to 1 be repreſented by 1, then the ratio of 100 to 1 muſt be 2, and that of 1000 to 1 muſt be 3, &c.; or if 2 was choſen to repreſent the ratio of 10 to 1, then that of 100 to 1 muſt be 4, that of 1000 to 1 muſt be 6, &c.; and no other numbers could poſſibly be uſed.

3. As thoſe artificial numbers repreſented, or were proportional to, the ratios of the natural numbers to unity, they muſt be expreſſions of the numbers of ſome ſmaller equal ratios contained in the former and larger ones. Thus, if we make 1 the repreſentative of the ratio of 10 to 1; then 3, which repreſents the ratio of 1000 to 1, will likewiſe expreſs the number of ratios of 10 to 1, which are contained in that of 1000 to 1. If inſtead of 1, we make 1000 to be the ratio of 10 to 1; then 3000 will expreſs the ratio of 1000 to 1, and this number 3000 will expreſs the number of ſmall ratios of the 1000th root of 10 to 1 contained in the ratio of 1000 to 1; and ſo on for any larger number, as 10,000, 100,000, or 10,000,000, &c. Thus, if inſtead of 1000 we make 10,000,000 the repreſentative of the ratio of 10 to 1, then the unit will repreſent a very ſmall ratio, of which there are 10,000,000 contained betwixt 1 and 10, and which ratio could not really be had without extracting a root which involved in itſelf, 10,000,000 of times would only make up 10; which root may perhaps be moſt intelligibly expreſſed thus, $^{10,000,000}\sqrt{10}$. If the ratio of 10 to 1 contained 10,000,000 of theſe roots, it is evident that the ratio of 100 to 1 muſt contain 20,000,000, that of 1000 would have 30,000,000, &c.; of conſequence, the ratio of 100 to 1 will be expreſſed by 20,000,000, of 1000 to 1 by 30,000,000, &c.—Hence, as theſe artificial numbers repreſent the ratios of natural numbers to unity, or are proportional to them, they are very properly called the *logarithms* of theſe numbers, or the *numbers* of their *ratios*; becauſe they really do expreſs this number of ratios.

The relation of logarithms to natural numbers may perhaps more intelligibly be explained by two ſeries of numbers, one in an arithmetical, and the other in geometrical, progreſſion. Thus,

Logarithms,	0	1	2	3	4	5	6	7	8
Nat. numb.	1	2	4	8	16	32	64	128	256

Or,

Logarithms,	0	1	2	3	4	5	6
Nat. numb.	1	10	100	1000	10,000	100,000.	1,000,000

In either of theſe ſeries it is evident, that by adding any two terms of the upper line together, a number will be had which indicates that produced by multiplying the correſponding terms of the lower line. Thus, in the firſt two ſeries, ſuppoſe we wiſh to know the product of 4×32. In the upper line we find 2 ſtanding over the number 4, and 5 over 32; adding therefore 5 to 2 we find 7, the ſum of this addition, ſtanding over 128, the product of the two numbers. In like manner, if we wiſh to divide 256 by 8, from the number which ſtands over 256, viz. 8, ſubtract that which ſtands over 8, viz 3; the remainder 5, which ſtands over 32, ſhows that the latter is the quotient of 256 divided by 8. Let it be required to involve 4 as high as the biquadrate or 4th power: Multiply 2, the number which ſtands over 4, by the index of the power to which the number is to be involved; which index is 4: the product 8, ſtanding over 256, ſhows that this laſt number is the biquadrate of 4 required. Laſtly, let it be required to extract the cube root of 64; divide the number 6, which ſtands over 64, by 3, the index of the root you wiſh to extract; the quotient 2, ſtanding over 4, ſhows that 4 is the root ſought.

Theſe examples are ſufficient to ſhow the great utility of logarithms in the moſt tedious and difficult parts of arithmetic. But though it is thus eaſy to frame a table of logarithms for any ſeries of numbers going on in geometrical progreſſion, yet it muſt be far more difficult to frame a general table in which the logarithms of every poſſible ſeries of geometricals ſhall correſpond with each other. Thus, though in the above ſeries we can eaſily find the logarithm of 4, 8, &c. we cannot find that of 3, 6, 9, &c.; and if we aſſume any random numbers for them, they will not correſpond with thoſe which have already been aſſumed for 4, 8, 16, &c. In the conſtruction of every table, however, it was evident, that the arithmetical or logarithmic ſeries ought to begin with 0; for if it began with unity, then the ſum of the logarithms of any two numbers muſt be diminiſhed by unity before we could find the logarithm of the product. Thus,

Logar.	1	2	3	4	5	6	7	8	9
Nat. N.	1	2	4	8	16	32	64	128	256

Here

Here let it be required to multiply 4 by 16; the number 3 ſtanding over 4, added to 5 which ſtands over 16, gives 8 which ſtands over 128: but this is not juſt; ſo that we muſt diminiſh the logarithm by 1, and then the number 7 ſtanding over 64 ſhows the true product. In like manner it appears, that as we deſcend below unity in a logarithmic table, the logarithms themſelves muſt begin in a negative ſeries with reſpect to the former; and thus the logarithm of 0 will always be infinite; negative, if the logarithms increaſe with the natural numbers; but poſitive, if they decreaſe. For as the geometrical ſeries muſt diminiſh by infinite diviſions by the common ratio, the arithmetical one muſt decreaſe by infinite ſubtractions, or increaſe by infinite additions of the common difference.

This property of numbers was not unknown to the ancient mathematicians. It is mentioned in the works of Euclid; and Archimedes made great uſe of it in his *Arenarius*, or treatiſe on the number of the ſands: and it is probable that logarithms would have been much ſooner invented, had the real neceſſity for them been ſooner felt; but this did not take place till the end of the 16th century, when the conſtruction of trigonometrical tables, and ſolution of perplexed aſtronomical problems, rendered them abſolutely indiſpenſable.

About this time it is probable that many people wiſhed to ſee ſuch tables of numbers, and were making attempts to conſtruct them; but the invention is certainly due to Lord Napier, baron of Merchiſton in Scotland. The invention is by ſome indeed aſcribed to Longomontanus; but with very little probability, as he never publiſhed any thing of the kind, nor laid claim to the invention, though he lived to ſee the publication of Baron Napier's tables. Concerning this invention we are told, that "one Dr Craig a Scotchman, coming out of Denmark into his own country, called upon Baron Napier, and told him of an invention of Longomontanus in Denmark, to ſave the trouble of the tedious multiplication and diviſion in aſtronomical calculations; but could give no farther account of it than that it was by proportionable numbers. From this ſlight hint the baron immediately ſet about the work; and by the time that Dr Craig returned to call upon him, he had prepared a rude draught of it, which he called *Canon mirabilis Logarithmorum*; and this draught, with ſome alterations, was printed in 1614.

According to Kepler, one Juſte Byrge, aſſiſtant aſtronomer to the landgrave of Heſſe, either invented or projected logarithms long before Baron Napier, and compoſed a table of ſines for every two ſeconds of the quadrant; though, by reaſon of his natural reſervedneſs, he never publiſhed any thing to the world. But whatever might have been in this, it is certain that the world is indebted for logarithms to Baron Napier, who died in the year 1618. This nobleman likewiſe made conſiderable improvements in trigonometry; and the frequent numerical computations he had occaſion for in this branch, undoubtedly contributed to his invention of the logarithms, that he might ſave part of the trouble in theſe calculations. His book publiſhed in 1614 was intitled *Mirifici Logarithmorum Canonis deſcriptio*. At this time he did not publiſh his method of conſtructing the numbers until the ſenſe of the learned ſhould be known. In other reſpects the work is complete, containing all the logarithms of the natural numbers to the uſual extent of logarithmic tables; with the logarithmic ſines, tangents, and ſecants, for every minute of the quadrant, directions for uſing the tables, &c.

This work was publiſhed in Latin; but was afterwards tranſlated into Engliſh by Mr Edward Wright, inventor of the principles of what has been falſely called *Mercator's Sailing*. The tranſlation was ſent to his lordſhip at Edinburgh, and returned with his approbation and ſome few additions. It was publiſhed in 1616, after Mr Wright's death, with a dedication to the Eaſt India Company, by his ſon Samuel Wright, and a preface by Mr Briggs, who afterwards diſtinguiſhed himſelf ſo much in bringing logarithms to perfection. In this tranſlation Mr Briggs alſo gave the deſcription and draught of a ſcale invented by Mr Wright, as well as other methods invented by himſelf, for finding the intermediate proportional numbers; the logarithms already found having been only printed for ſuch numbers as were the natural ſines of each minute.

Mr Wright's tranſlation was reprinted in 1618, with a new title-page, and the addition of 16 pages of new matter, "ſhowing the method of calculating triangles, as well as a method of finding out ſuch lines and logarithms as are not to be found in the canons."

Next year John Speidell publiſhed his New Logarithms, in which were ſome remedies for the inconveniences attending Lord Napier's method. The ſame year alſo Robert Napier, the Baron's ſon, publiſhed a new edition of his father's book, entitled *Canonis Logarithmorum Deſcriptio;* with another concerning the method of conſtructing them, which the Baron had promiſed; together with ſome other miſcellaneous pieces, which his father had likewiſe compoſed along with Mr Briggs. In 1620 alſo, a copy of theſe works was printed at Lyons in one volume, by Bartholomew Vincent a bookſeller there; but this publication ſeems to have been but little known, as Wingate, who carried logarithms to France four years after, is ſaid to have been the firſt who introduced them into that country.

The *Curſus Mathematicus* publiſhed at Cologn in 1618 or 1619 by Benjamin Urſinus, mathematician to the elector of Brandenburg, contains a copy of Napier's logarithms, together with ſome tables of proportional parts. In 1624 he publiſhed his *Trigonometria*, with a table of natural ſines and their logarithms, according to Lord Napier's method, to every ten ſeconds in the quadrant. The ſame year a book on logarithms was publiſhed at Marpurg by the celebrated Kepler, of the ſame kind with thoſe of Napier. Both of theſe begin at 90° or the end of the quadrant; and, while the ſines decreaſe, the logarithms gradually increaſe; till at the beginning of the quadrant, or 0, the logarithm is infinite. The only difference betwixt the logarithms of Napier and Kepler is, that in the former the arc is divided into equal parts, differing by one minute each; and conſequently their ſines to which the logarithms are adapted are interminate numbers repreſented only by approximating decimals: but in Kepler's table, the radius is divided into equal parts; which are conſidered as perfect and terminate ſines, having equal differences, and to which the logarithms are here adapted,

adapted. A treatiſe of ſome extent was prefixed to the work; in which the conſtruction and uſe of logarithms is pretty largely treated of. In the year 1627 the ſame author introduced logarithms into his Rudolphine Tables, together with ſeveral others, *viz.* 1. A table ſimilar to that already mentioned; only that the column of ſines or abſolute numbers is omitted, and another added in its ſtead, ſhowing what part of the quadrant each arc is equal to; *viz.* the quotient ariſing from the diviſion of the whole quadrant by each given arc, and expreſſed in integers and ſexageſimal parts. 2. Napier's table of logarithmic ſines to every minute of the quadrant; as alſo two other ſmaller tables adapted for the calculation of eclipſes and the latitude of planets. In this work Juſtus Byrgius is mentioned as having invented logarithms before Napier.

The kind of logarithms now in uſe were invented by Mr Henry Briggs profeſſor of geometry in Greſham college, London, at the time they were firſt diſcovered by Napier. As ſoon as the logarithms of Napier were publiſhed, Mr Briggs directed his attention to the ſtudy and improvement of them; and his employment in this way was announced in a letter to Mr Uſher, afterwards the celebrated archbiſhop, in the year 1615. By him the ſcale was changed, and 0 was made the logarithm of 1; but lord Napier informed Mr Briggs that he had already thought of ſuch a ſcheme, but choſe rather to publiſh the logarithmic tables he had completed, and to let thoſe alone until he ſhould have more leiſure as well as better health. At an interview betwixt Lord Napier and Mr Briggs, the preſent plan ſeems to have been ſettled; and in conſequence of his lordſhip's advice, Mr Briggs made ſome alteration in the method of conſtructing his tables from that which he had begun. A correſpondence alſo took place betwixt his lordſhip and Mr Briggs, which continued during the lifetime of the former. It appears, however, that, whether Mr Briggs thought of this alteration before lord Napier or not, he certainly was the perſon who firſt publiſhed it to the world; and ſome reflections have been thrown upon his lordſhip for not making any mention of the ſhare which Mr Briggs had in it.

In 1617 Mr Briggs publiſhed his firſt thouſand logarithms under the title of *Logarithmorum Chilias Prima*; and in 1620 Mr Edward Gunter publiſhed his Canon of Triangles, containing the artificial or logarithmic ſines and tangents for every minute, to ſeven places of figures beſides the index; the logarithm of the radius being 10.000, &c. Theſe were the firſt tables of logarithmic ſines, tangents, &c. which made their appearance upon the preſent plan; and in 1623 they were reprinted in his book de *Sectore et Radio*, along with the *Chilias Prima* of Mr Briggs. The ſame year Mr Gunter applied theſe logarithms of numbers, ſines, and tangents, to ſtraight lines drawn on a ruler; and with theſe the proportions in common numbers, as well as in trigonometry, were ſolved by the mere application of a pair of compaſſes; a method founded upon this property, that the logarithms of the terms of equal ratios are equally different. The inſtrument is now well known by the name of the two-feet Gunter's Scale. By the ſame methods he alſo greatly improved the ſector. He was alſo the firſt who uſed the word *coſine* for the ſine of the complement of an arc; and he introduced the uſe of arithmetical complements into the logarithmical arithmetic. He is ſaid alſo to have firſt ſuggeſted the idea of the logarithmic curve, ſo called becauſe the ſegments of its axis are the logarithms of the correſponding ordinates.

The logarithmic lines were afterwards drawn in many other ways. Wingate, in 1627, drew them upon two ſeparate rulers ſliding by each other, in order to ſave the uſe of compaſſes in reſolving proportions. In 1627 alſo, they were applied by Mr Oughtred to concentric circles; about 1650, in a ſpiral form, by one Mr Milburne of Yorkſhire; and in 1657, they were applied on the preſent ſliding-rule by Mr Seth Partridge.

The knowledge of logarithms was diffuſed in France by Mr Edmund Wingate, as already related, though not carried originally thither by him. Two ſmall tracts were publiſhed by him in French, and afterwards an edition in Engliſh, all printed in London. In the firſt of theſe he mentions the uſe of Gunter's Ruler; and in the other that of Briggs's Logarithms, with the canon of artificial ſines and tangents. There are likewiſe tables of theſe ſines, tangents, and logarithms, copied from Gunter.

From the time that Mr Briggs firſt began to ſtudy the nature of logarithms, he applied to the conſtruction of tables with ſuch aſſiduity, that by the year 1624 he publiſhed his *Arithmetica Logarithmica*, containing the logarithms of 30,000 natural numbers to 14 places of figures beſides the index; *viz.* from 1 to 20,000, and from 90,000 to 100,000, together with the differences of the logarithms. According to ſome, there was another Chiliad, *viz.* from 100,000 to 101,000; but this does not ſeem to be well authenticated. In the preface to this work, he gives an account of the alteration made in the ſcale by Lord Napier and himſelf; and earneſtly ſolicits other perſons to undertake the taſk of filling up the intermediate numbers; offering to give inſtructions, and to afford paper ready ruled for the purpoſe. He gives alſo inſtructions at large in the preface for the conſtruction of logarithmic tables. Thus he hoped to get the logarithms of the other 70,000 natural numbers completed; while he himſelf, being now pretty far advanced in years, might be at liberty to apply to the canon of logarithmic ſines, &c. which was as much wanted by mathematicians as the others. His wiſhes were accompliſhed by Adrian Vlacq or Flack of Gouda in Holland, who completed the numbers from 20 to 90,000; and thus the world was furniſhed with the logarithms of all natural numbers from 1 to 100,000; but thoſe of Vlacq were only done to 10 places of figures. To theſe was added a table of artificial ſines, tangents, and ſecants, to every minute of the quadrant. Beſides the great work already mentioned, Mr Briggs completed a table of logarithmic ſines and tangents for the 100th part of every degree, to 14 places of figures beſides the index; and a table of natural ſines for the ſame parts to 15 places, with the tangents and ſecants to 10 places, and the methods of conſtructing them. He deſigned alſo to have publiſhed a treatiſe concerning the uſes and application of them, but died before this could be accompliſhed. On his death-bed he recommended this work to Henry Gellibrand profeſſor of

aſtronomy

aſtronomy in Greſham college, in which office he had ſucceeded Mr Gunter. Mr Briggs's tables above mentioned were printed at Gouda, and publiſhed in 1633; and the ſame year Mr Gellibrand added a preface with the application of logarithms to plane and ſpherical trigonometry, the whole being denominated *Trigonometria Britannica:* and beſides the arcs in degrees and hundredth parts, has another table containing the minutes and ſeconds anſwering to the ſeveral hundredth parts in the firſt column.

The *Trigonometria Artificialis* of Vlacq contains the logarithmic ſines and tangents to 10 places of figures, to which is added Briggs's firſt table of logarithms from 1 to 20,000, beſides the index: The whole preceded by a deſcription of the tables, and the application of them to plane and ſpherical trigonometry, chiefly extracted from Briggs's *Trigonometria Britannica* already mentioned. In 1635, Mr Gellibrand alſo publiſhed a work, intitled, *An Inſtitution Trigonometrical*, containing the logarithms of the firſt 10,000 numbers, with the natural ſines, tangents, and ſecants; and the logarithmic ſines and tangents for degrees and minutes, all to ſeven places of figures beſides the index; likewiſe other tables proper for navigation, with the uſes of the whole. Mr Gellibrand died in 1636, in the 40th year of his age.

A number of other people have publiſhed books on logarithms, which we cannot now particularly enumerate. Some of the principal are:

1. A treatiſe concerning Briggs's logarithms of common numbers from 1 to 20,000, to 11 places of figures, with the logarithmic ſines and tangents but only to eight places. By D. Henrion at Paris, 1626.

2. Briggs's logarithms, with their differences to 10 places of figures, beſides the index for all numbers to 100,000; as alſo the logarithmic ſines, tangents, and ſecants, for every minute of the quadrant, with the explanation and uſes in Engliſh. By George Miller, Lond. 1631.

3. *Trigonometria*, by Richard Norwood, 1631; containing Briggs's logarithms from 1 to 10,000, as well as for the ſines, tangents, and ſecants to every minute, both to ſeveral places of figures beſides the index. The author complains very much of the unfair practices of both the former authors.

4. *Directorium Generale Uranometricum;* by Francis Bonaventure Cavalerius. Bologna, 1632. In this are Mr Briggs's tables of logarithmic ſines, tangents, ſecants, and verſed ſines each to eight places of figures for every ſecond of the firſt 5 minutes, for every 5 ſeconds from 5 to 10 minutes, for every 20 ſeconds from 20 to 30 minutes, for every 30 ſeconds from 30 minutes to $1\frac{1}{2}$ degree, and for every minute in the reſt of the quadrant. It contains alſo the logarithms of natural numbers from 1 to 10,000, with the firſt table of verſed ſines that ever was publiſhed. The author likewiſe gives the firſt intimation of the method of finding the arcs or ſpherical ſurface contained by various arcs deſcribed on the ſurface of a ſphere.

5. In 1643 appeared the *Trigonometria* of the ſame author, containing the logarithms of the natural numbers from 1 to 1000, with their differences to eight places of figures; likewiſe a table of natural and logarithmic ſines, tangents, and ſecants; the former to ſeven, the latter to eight, places of figures; *viz.* to every 10″ of the firſt 30′, to every 30″ from 30′ to 1°, and the ſame for their complements, or backwards thro' the laſt degree of the quadrant; the intermediate 88° being only to every minute.

6. *Tabulæ Logarithmicæ;* by Mr Nathaniel Rowe, paſtor of Benaire in Suffolk: Lond. 1633. In this work are contained Briggs's logarithms of natural numbers from 1 to 100,000, to eight places of figures; likewiſe the logarithmic ſines and tangents to every 100th part of degrees to ten places.

7. *Clavis Univerſa Trigonometriæ;* Hamburg, 1634: containing tables of Briggs's logarithms from 1 to 2000; and of ſines, tangents, and ſecants, for every minute, both for ſeven places.

8. *Trigonometria Britannica*, by John Newton, London, 1658. In this the logarithmic tables of natural numbers were reduced to their moſt convenient form; the author having availed himſelf of the labours of Wingate and Roe, uniting their ſeveral methods, and diſpoſing of the whole as in the beſt logarithmic tables uſed at preſent. It contains likewiſe the logarithmic ſines and tangents to eight figures beſides the index; for every hundredth part of a degree, with the differences, and for thouſandth parts in the firſt three degrees. He cenſures the unfair practices of ſome former publiſhers of logarithms; particularly of Vlacq already mentioned.

9. *Matheſis Nova*, by John Caramual, 1670. This contained 1000 logarithms, both of the forms of Napier and Briggs, as well as 1000 of what he calls *perfect logarithms*, viz. thoſe of Briggs's firſt method of conſtruction; which differs from the laſt only in this, that the laſt increaſes, whilſt the firſt decreaſes; the radix or logarithm of the ratio of 10 to 1 being the very ſame in both.

10. Sherwin's Mathematical Tables, publiſhed in 8vo, form the moſt complete collection of any; containing, beſides the logarithms of all numbers to 101,000, the ſines, tangents, ſecants, verſed ſines both natural and logarithmic, to every minute of the quadrant. The firſt edition was printed in 1706; but the third, publiſhed in 1742 and reviſed by Gardiner, is looked upon to be ſuperior to any other. The fifth and laſt edition, publiſhed in 1771, is ſo incorrect, that no dependence can be placed upon it.

10. Tables of logarithms from 1 to 102,100, and for the ſines and tangents to every 10 ſeconds of each degree in the quadrant; as alſo for the ſines of the firſt 72 minutes to every ſingle ſecond, with other uſeful and neceſſary tables. By Gardiner, London, 1742. This work contains a table of logiſtical logarithms, and three ſmaller tables to be uſed for finding the logarithms of numbers to 20 places of figures. Only a ſmall number of theſe tables was printed, and that by ſubſcription; and they are now in the higheſt eſteem for accuracy and uſefulneſs. An edition of theſe tables was printed at Avignon in France in 1770, with the addition of ſines and tangents for every ſingle ſecond in the firſt four degrees, and a ſmall table of hyperbolic logarithms, taken from a treatiſe upon fluxions by the late Mr Thomas Simſon. The tables are to ſeven places of figures, but ſomewhat leſs correct than thoſe publiſhed by Gardiner himſelf.

11. An Antilogarithmic Canon for readily finding the number correſponding to any logarithm, was begun by

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the algebraiſt Mr Harriot, who died in 1621; and completed by Mr Walter Warner, the editor of Harriot's works, before 1640, but never was publiſhed for want of encouragement to print it. In 1714 a ſmall ſpecimen of ſuch a canon appeared in the Philoſophical Tranſactions for that year by Mr Long of Oxford; and in 1742 a complete Antilogarithmic Canon appeared by Mr James Dodſon, in which the numbers correſponding to each logarithm from 1 to 100,000 are computed to 11 places of figures.

12. In 1783 were publiſhed M. Callet's tables at Paris; which for the elegance of the workmanſhip are much ſuperior to any thing of the kind that ever appeared, though their accuracy is not eſteemed equal to that of ſome others. The work is a neat volume ſmall 8vo. It contains a treatiſe on logarithms, with their uſes and application to various ſciences; as trigonometry, aſtronomy, and navigation; a table of logarithms from 1 to 102,960, with the differences; a table of ſines and tangents for every ſingle ſecond of the firſt two degrees, and for every 10 ſeconds of the reſt of the quadrant; with tables of logiſtical and hyperbolic logarithms, and ſome others for determining the longitude at ſea.

Sect. II. *Different methods of conſtructing Logarithms.*

§. 1. *Napier's method.*

The logarithms firſt thought of by Lord Napier were not adapted to the natural ſeries of arithmetical numbers 1, 2, 3, &c. becauſe he did not then intend to adapt them to every kind of arithmetical calculation, but only to that particular operation which had called for their immediate conſtruction, viz. the ſhortening of trigonometrical operations: he explained the generation of logarithms, therefore, in a geometrical way. Both logarithms, and the quantities to which they correſpond, in his way, may be ſuppoſed to proceed from the motion of a point; which, if it moves over equal ſpaces in equal times, will produce a line increaſing equally: but if, inſtead of moving over equal ſpaces in equal times, the point deſcribes ſpaces proportional to its diſtances from a certain term, the line produced by it will then increaſe proportionably. Again, if the point moves over ſuch ſpaces in equal times, as are always in the ſame conſtant ratio to the lines from which they are ſubducted, or to the diſtance of that point at the beginning of the lines, from a given term in that line, the line ſo produced will decreaſe proportionably. Thus, let *ac* be to *ao*, *cd* to *co*, *ef* to *fo*, and *fg* to *fo*, always in a certain ratio, viz. that of QR to QS, and let us ſuppoſe the point P to ſet *f* out from *a*, deſcribing the diſtances *ac*, *cd*, *de*, &c. in equal ſpaces of time, then will the line *ao* decreaſe proportionably.

Plate CCLXXIII fig. 1, 2.

In like manner, the line *oa*, (fig. 12.) increaſes proportionally, if the point *p*, in equal times, deſcribes the ſpaces *ac*, *cd*, *de*, *fg*, &c. ſo that *ac* is to *ao*, *cd* to *co*, *de* to *do*, &c. in a conſtant ratio. If we now ſuppoſe a point P deſcribing the line AG (fig. 4.) with an uniform motion, while the point *p* deſcribes a line increaſing or decreaſing proportionally, the line AP, deſcribed by P, with this uniform motion, in the ſame time that *oa*, by increaſing or decreaſing proportionally, becomes equal to *op*, is the logarithm of *op*. Thus AC, AD, AE, &c. are the logarithms of *oc*, *od*, *oc*, &c. reſpectively: and *oa* is the quantity whoſe logarithm is ſuppoſed equal to nothing.

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We have here abſtracted from numbers, that the doctrine may be the more general; but it is plain, that if AC, AD, AE, &c. be ſuppoſed 1, 2, 3, &c. in arithmetic progreſſion; *oc*, *od*, *oe*, &c. will be in geometric progreſſion; and that the logarithm of *oa*, which may be taken for unity, is nothing.

Lord Napier, in his firſt ſcheme of logarithms, ſuppoſes, that while *op* increaſes or decreaſes proportionally, the uniform motion of the point P, by which the logarithm of *op* is generated, is equal to the velocity of *p* at *a*; that is, at the term of time when the logarithms begin to be generated. Hence logarithms, formed after this model, are called *Napier's Logarithms*, and ſometimes *Natural Logarithms*.

When a ratio is given, the point *p* deſcribes the difference of the terms of the ratio at the ſame time. When a ratio is duplicate of another ratio, the point *p* deſcribes the difference of the terms in a double time. When a ratio is triplicate of another, it deſcribes the difference of the terms in a triple time; and ſo on. Alſo, when a ratio is compounded of two or more ratios, the point *p* deſcribes the difference of the terms of that ratio in a time equal to the ſum of the times in which it deſcribes the differences of the terms of the ſimple ratios of which it is compounded. And what is here ſaid of the times of the motion of *p* when *op* increaſes proportionally, is to be applied to the ſpaces deſcribed by P, in thoſe times, with its uniform motion.

Hence the chief properties of logarithms are deduced. They are the meaſures of ratios. The exceſs of the logarithm of the antecedent above the logarithm of the conſequent, meaſures the ratio of thoſe terms. The meaſure of the ratio of a greater quantity to a leſſer is poſitive; as this ratio, compounded with any other ratio, increaſes it. The ratio of equality, compounded with any other ratio, neither increaſes nor diminiſhes it; and its meaſure is nothing. The meaſure of the ratio of a leſſer quantity to a greater is negative; as this ratio, compounded with any other ratio, diminiſhes it. The ratio of any quantity A to unity, compounded with the ratio of unity to A, produces the ratio of A to A, or the ratio of equality; and the meaſures of thoſe two ratios deſtroy each other when added together; ſo that when the one is conſidered as poſitive, the other is to be conſidered as negative. By ſuppoſing the logarithms of quantities greater than *oa* (which is ſuppoſed to repreſent unity) to be poſitive, and the logarithms of quantities leſs than it to be negative, the ſame rules ſerve for the operations by logarithms, whether the quantities be greater or leſs than *oa*. When *op* increaſes proportionally, the motion of *p* is perpetually accelerated; for the ſpaces *ac*, *cd*, *de*, &c. that are deſcribed by it in any equal times that continually ſuecced after each other, perpetually increaſe in the ſame proportion as the lines *oa*, *oc*, *od*, &c. When the point *p* moves from *a* towards *o*, and *op* decreaſes proportionally, the motion of *p* is perpetually retarded; for the ſpaces deſcribed by it in any equal times that con-

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continually ſucceed after each other, decreaſe in this caſe in the ſame proportion as *op* decreaſes.

If the velocity of the point *p* be always as the diſtance *op*, then will this line increaſe or decreaſe in the manner ſuppoſed by Lord Napier; and the velocity of the point *p* being the fluxion of the line *op*, will always vary in the ſame ratio as this quantity itſelf. This, we preſume, will give a clear idea of the geneſis or nature of logarithms; but for more of this doctrine, ſee Maclaurin's Fluxions.

The conſtruction of his tables of logarithms was firſt publiſhed in his poſthumous work of 1619. The conſtruction of his canon was chiefly effected by generating, in an eaſy manner, a ſeries of proportional numbers, and their arithmeticals or logarithms; and then finding by proportion the logarithms of the natural ſines from thoſe of the neareſt numbers among the original proportionals. Beginning then at the radius 10,000,000, he firſt conſtructs ſeveral deſcending geometrical ſeries, of ſuch a nature that they are quickly formed by an eaſy addition or ſubtraction, or diviſion by 2, 10, 100, &c. His firſt table conſiſts of proportionals in the ratio of 10,000,000 to 9,999,999; the method of doing which may be eaſily underſtood from the following example: Suppoſe it were required to find a ſeries of deſcending proportionals in the ratio of 100 to 99; it may be done by adding two cyphers to each of the two firſt terms, and continually adding 1 to the decimal place fartheſt to the right hand. Thus the firſt term will be 100.00, the ſecond 99.00, the third 98.01, the fourth 98.03, &c. Napier's firſt table contained 100 terms of a ſeries, as we already mentioned, in the proportion of 10,000,000 to 9,999,999. The firſt term of which ſeries was 10,000,000.0000000; the ſecond 9,999,999.0000000; the third was 9,999,998.0000001, and ſo on till the 100th term, which was 9,999,900.0004950. The ſecond table conſiſted of 50 numbers nearly in the proportion of 100,000 to 99,999; and this was formed by ſubſtituting the units 1, 3, &c. in the third decimal place inſtead of the laſt place towards the right hand. The reaſon of conſtructing this table was, that he might have a ſeries in the proportion of his firſt term of the former to the laſt term of it, *viz.* of 100,000 to 99,999; and the laſt of the ſecond ſeries was 9995001.222927. In all theſe ſeries the method of finding the terms is exactly the ſame. Thus in the firſt example, where we begin with 100, each term decreaſes by the 100th part of the former; and this 100th part is found by removing the number two places of figures lower, and ſubſtracting them from the former terms. Thus 99 is leſs than 100 by unity, which is the 100th part of the latter; the next term is leſs than 99 by the 100th part of 99, and is therefore 98.01. But the diviſion by 100 can be performed without any trouble, only ſetting the decimal point two places farther forward, as that by 10 is performed by ſetting it one place farther forward; thus $9 \div 10 = .9$; $99 \div 100 = .99$. Now by ſubtracting 99 from 100, we have 98.01 for the third term of the ſeries. To find the fourth term then, remove the decimal point two figures farther to the right hand, and ſubtract it from the former; and we have then 97.0299 for the fourth term of the ſeries. Thus we ſee, that the number of decimal places muſt continually increaſe; but as in this ſeries we want no more than two decimal places inſtead of 97,0299, the term is made 97.03, as the neareſt number which has only two decimal places, and differs from the truth only by one thouſandth part In like manner, in the long ſtring of ciphers, the fourth term of the ſeries differs ſomewhat, but very little, from the truth: and this muſt always be the caſe while the radius is ſuppoſed to conſiſt of any finite number of parts; though, by going on for a very long time in this way, the error, by being continually repeated and augmented at every term, would at laſt become perceptible; and therefore none of theſe ſeries are carried on to a very great length.

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His next ſtep was to conſtruct a third table conſiſting of 69 columns, and each column of 21 numbers or terms in the continual proportion of 10000 to 9995; that is, nearly as the firſt term of the ſecond table is to its laſt term. As this proportion is the 200th of the whole, the method of finding the terms will be by dividing each upper number by 2, and removing the figures of the quotient three places lower, and then ſubtracting them. In this way, however, it is proper to collect only the firſt column of 21 numbers, the laſt of which will be 9900473.5780: but the firſt, ſecond, and third, &c. numbers in all the other columns are in the continual proportion of 100 to 99, or nearly of the firſt to the laſt in the firſt column; whence theſe are to be found by removing the figures two places lower, and then ſubtracting them, as has already been explained.

By theſe three tables, his lordſhip was furniſhed with about 1600 proportionals, nearly coinciding with all the natural ſeries from 90 to 30 degrees. To obtain the logarithms of thoſe proportionals, he demonſtrated and applied ſome of the properties and relations of the numbers and logarithms; the principal of which are, 1. That the logarithm of any ſine is greater than the difference between that ſine and the radius, but leſs than that difference when increaſed in the proportion of the ſine to the radius. 2. That the difference between the logarithms of two ſines is leſs than the difference of the ſines increaſed in the proportion of the leſſer ſine to the radius, but greater than the difference of the ſines increaſed in the proportion of the greater ſine to the radius. Theſe properties now ſerved him as theorems for finding the logarithms themſelves in an eaſy manner. From the firſt of them it appeared, that the radius being 10,000,000, the firſt term of the table, the logarithm of 9,999,999, the ſecond term, muſt be greater than the difference betwixt that term and the radius, which is 1, but leſs than the difference when increaſed in the proportion of the ſine to the radius; but this proportion is only one ten millionth part, for $9{,}999{,}999 \times 1.0000001 = 10{,}000{,}000$; whence the logarithm of the radius or 10,000,000 being 0, the logarithm of 9,999,999 the ſecond term will be between 1 and 1.0000001, or very nearly 1.00000005, this being the arithmetical mean betwixt 1 and 1.0000001. This will alſo be the common difference betwixt every two ſucceeding terms in the firſt table; becauſe all the terms there are in the ſame proportion of 10,000,000 to 9,999,999. Hence by the continual addition of this logarithm we have the logarithms of the whole ſeries, and therefore that of the laſt term of the ſeries *viz.* 9999900.0004950 will be 100.00005.

The ſecond table, as we have already ſaid, conſiſts of

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of a ſeries of numbers in the continual proportion of 100000 to 99999 whence the firſt term being 10,000,000 the ſecond will be 9,999,900; the difference betwixt this and the laſt term of the former ſeries is .0004950. But by the ſecond theorem, the difference between the logarithms of 9,999,900.0004950 and 9,999,900, the ſecond term of the ſecond table, will be leſs than .0004950, increaſed in the proportion of 99999 to 100000, but greater than .0004950, increaſed in the proportion of 9,999,900.0004950; that is to ſay, if we augment .0004950 by one hundred thouſandth part, it will be greater than the difference betwixt the logarithms of the two terms. The limits, therefore, are here ſo extremely ſmall, that we may account the difference betwixt the two terms and that of the logarithms themſelves the ſame: adding therefore this difference .0004950 to 100.000005, we have 100.0005000 for the logarithm of the ſecond term, and likewiſe for the common difference of all the logarithms of the terms of the ſecond table. — Again, by the ſame theorem, the difference between the logarithms of this laſt proportional of the ſecond table and the ſecond term in the firſt column of the third table, will be found to be 1.2235287; which added to the laſt logarithm, gives 5001.2485387 for the logarithm of 9,995,000, the ſecond term of the third table: and in a ſimilar manner, by the ſame theorem, he finds the logarithms of all the other terms of the reſt of the columns.

Thus our author completed what he calls his radical table, from which he found his logarithmic ſines by taking, according to the ſecond theorem, the ſum and difference of each tabular ſine, and the neareſt number in the radical table. Annex then ſeven ciphers to the difference; divide the number by the ſum, and half the quotient will be the difference between the logarithms of the tabular ſine and radical number; and conſequently, by adding or ſubtracting this difference to or from the logarithm of the natural number, we have the logarithmic ſine required.

In this manner were completed the logarithmic ſines from radius or ſine of 90° to the half of it, or ſine of 30°. To complete the other 30°, he obſerves, that the logarithm of the ratio of 2 to 1, or of one half the radius, is 6931469.22; that of the ratio of 4 to 1 is double of it; that of 8 to 1, triple of it, &c.; and thus going on to compute the logarithms of the ratio between 1 and 40, 80, 100, &c. to 10,000,000: then multiplying any given ſine for an arc leſs than 30° by ſome of theſe numbers, he finds the product nearly equal to ſome number in the table; and then finds the logarithm by the ſecond theorem as already directed.

Another, and much eaſier method, however, of performing the ſame thing is founded upon the following proportion, which he demonſtrates, *viz.* that as half the radius is to the ſine of half an arc, ſo is the coſine of the half arc to the ſine of the whole arc; or as one half the radius is to the ſine of any arc, ſo is the coſine of that arc to the ſine of double the arc. Hence the logarithmic ſine of an arc is found by adding the logarithms of half the radius and the ſine of double the arc, and then ſubtracting the logarithmic coſine from the ſum. In this way, he obſerves that the ſines for full one half of the quadrant may be found, and the remainder by one eaſy diviſion, or addition and ſubtraction for each, as already directed. Conſtruction of Logarithms

§. 2. *Kepler's method of conſtruction.*

This was founded upon principles nearly ſimilar to that of Napier. He firſt of all erects a ſyſtem of proportions, and the meaſures of proportion, founded upon principles purely mathematical; after which he applies theſe principles to the conſtruction of his table, containing only the logarithms of 1000 numbers. The propoſitions on which his method is founded are in ſubſtance the following.

1. All equal proportions equal among themſelves are expreſſed by the ſame quantity, be the terms many or few; as the proportion of 2, 4, 8, &c. in geometrical progreſſion is expreſſed by 2; and of 2, 6, 18, 54, &c. by 3.

2. Hence the proportion of the extremes is compoſed of all the proportions of the intermediate terms; thus the proportion of 2 to 8 its compounded of that 2 to 4, and of 4 to 8.

3. The mean proportional betwixt two terms divides that propoſtion into two equal ones. Thus the proportion between 2 and 32 is divided by the mean proportional 8 into two equal proportions of 4; for 2 is to 8, as 8 is to 32.

4. In any number of proportionals regularly increaſing, the means divide the proportion of the extremes into one more than their own number. Thus, in the ſeries 2, 4, 8, 16, the proportion of the extremes 2 and 16 is by the *two* means 4 and 8, divided into *three* proportions, viz. that betwixt 2 and 4, 4 and 8, 8 and 16. In like manner, in the ſeries 3, 6, 18, 54, 162, 486, the proportion betwixt 3 and 486 is divided by the four means into the five proportions of 3 to 6; 6 to 18; 18 to 54; 54 to 162; and 162 to 486.

5. The proportion betwixt any two terms is diviſible into any number of parts, until theſe become leſs than any aſſignable quantity. Thus the proportion of 2 to 8 is diviſible, by multiplying the two together and extracting the ſquare root, into two parts by the number 4: by multiplying 2 and 4 together, and extracting the ſquare root, and doing the ſame with 4 and 8, the proportion would be divided into four parts, viz. $2.\sqrt{8}.4.\sqrt{32}.8$; or in numbers, 2 : 2.813, &c. : 4 : 5.655, &c. : 8.

6. By dividing the ratios in this manner, the elementary part will become at laſt ſo ſmall, that it may be denominated by the mere difference of terms of that element. This is evident from the diminution of the ratios or proportions already inſtanced: for the proportion between 2 and 2.813 is only 1.406, &c. and if we were to find a mean proportional betwixt 2 and 2.813, the ratio betwixt that proportional and 2 would be much leſs. But it muſt always be remembered, that ſuch *evaneſcent* quantities, as they are called, cannot give us any concluſion with abſolute exactneſs, however they may anſwer every uſeful purpoſe to us: for it is evident that neither mean proportional nor ratio can ever be found exactly; and therefore the error accumulated in all the operations muſt become very conſiderable, if any circumſtance ſhall happen to make it appear.

7. In three continued proportionals, the difference

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of the two first has to the difference between the two last the same proportion that the first term has to the second, or the second to the third. Thus, in the three terms, 4, 8, 16, the difference between the two first terms 4 and 8, viz. 4, is in proportion to 8; and the difference between the two last, as 4 is to 8, or 8 to 16.

8. In continued proportionals, the greatest terms have the greatest differences, and *vice versa*. Thus the difference between 8 and 16 is evidently greater than between 2 and 4 or 4 and 8.

9. If the difference betwixt the two greatest terms be made the measure of the proportion between them, the difference between any two others will be less than the true measure of their proportion. Thus in the series 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, &c. where the difference 2 betwixt the two greatest terms expresses their true proportion, it is plain, that the difference 1 betwixt 2 and 1 is less than their ratio, as well as between $\frac{1}{2}$ and $\frac{1}{4}$, &c.

10. In any series of proportionals, if the difference betwixt the greatest term and one not immediately next to it, be taken as the measure of the proportion, then the proportion betwixt the greatest term and any other greater than the term before taken, will be less than the difference of those terms; but the proportion which is between the greatest term and any one less than that first taken, will be greater than their difference. As proportionals of this kind do not readily occur, we shall, in order to avoid obscurity, show once for all, that there is a possibility of finding geometrical proportionals of such a nature, that the ratio may be equal to the difference betwixt the greatest and third, or any other term distant from it. Thus let us begin with any two numbers we please, suppose 9 and 10: though these are in the natural arithmetical proportion, yet if we make the ratio 1.111, they will also be geometrically proportional, and the series will run thus:

1st term	2d term	3d term	4th term	5th term	6th term
10 :	9 :	8.099 :	7.289 :	6.560 :	5.904, &c.

Here the difference betwixt the first and third terms is 1.901, which is greater than the ratio; that betwixt the second and fourth, viz. 1.711, is still greater, but nearer to it than the former; the difference between the third and fifth terms, viz. 1.539, still approximates, as does that between the fourth and sixth, viz. 1.385: and indeed by continuing this series only for two terms longer, the difference will become smaller than the ratio. It is not worth while, however, to seek for series of this kind, as the present proposition will now be sufficiently intelligible without any farther illustration.

11. If quantities be arranged according to the order of their magnitudes, and if any two successive proportions of these be equal, the three successive terms which constitute them will also be equal. Thus, if the two quantities 12 and 8 constitute the proportion $\frac{12}{8}$, and each of them be lessened by 6, the half of 12, we have the proportion $\frac{6}{2}$; which is more than double the original proportion; for $\frac{6}{2}=3$, and $\frac{12}{8} \times \frac{12}{8}$, $=\frac{9}{4}=2\frac{1}{4}$.

12. When quantities are placed in the order of their magnitudes, if the intermediate magnitudes lying between any two terms be not among the mean proportionals which can be interposed betwixt these two terms, then these intermediates will not divide the proportion of those two terms into commensurable proportions. Thus in the magnitudes 343 : 216 : 125 : 64 : 27 : 8, neither of the two intermediate terms 125 and 64 are mean proportionals betwixt 27 and 216, nor do they divide the proportion betwixt these into commensurable parts.

13. All the proportions taken in order, which are between expressible terms that are in arithmetical proportion, are incommensurable to one another; as between 8, 13, and 18.

14. When quantities are placed in the order of their magnitude, if the difference between the two greatest be made the measure of their proportion, the difference between any two others will be less than the measure of *their* proportion; and if the difference between the two least terms be made the measure of their proportion, the differences of the rest will be greater than the measure of the proportion between their terms.

15. If the measure of proportion between the greatest exceed their difference, then the proportion of this measure to the difference will be less than that of a following measure to the difference of its terms; because proportionals have the same ratio.

16. If three equidifferent quantities are taken in order, the proportion between the extremes is more than double that betwixt the two greater terms. Hence it follows, that half the proportion of the extremes is greater than the proportion between the greatest terms, but less than the proportion of the two least.

17. If two quantities constitute a proportion, and each be lessened by half the greater, the remainder will constitute a proportion more than double the former.

18. If 1000 numbers follow one another in the natural order, 1000, 999, 998, &c. and by continual multiplication and extraction of the square root we find mean proportionals, and thus *bisect*, as it is called, the ratio between the two greatest, so that the parts into which the ratio is divided become ultimately smaller than the excess of proportion betwixt the next two over the former (for 998 bears a greater proportion to 999 than 999 bears to 1000); the measure of this very small part or element of the proportion may be supposed to be the difference between 1000 and that mean proportional which is the other term of the element. Thus, for the sake of an easy explanation, let us suppose the numbers to be 10, 9, 8, &c. the ratio of 9 to 10 is 1.11, that of 9 to 8 is 1.125, the difference between which is .014, which we may call the elementary part of the ratios. By six extractions of the square root we have the mean proportional 9.985, &c. differing from 10 by no more than .015, which is very near the element just mentioned. The number of parts into which the ratio is thus divided is expressed by the 6th power of 2 or 64. Dividing therefore the ratio between 9 and 10 or 1.11 by 64, we have .017 for the elementary part thus obtained; which near coincidence with the real element, and the difference between 10 and the mean proportional itself, shows that in large numbers we may take the difference between the mean proportional and greatest term for the elementary part without any sensible error.

Suppose now, that the proportion between 1000 and

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and 998 be divided into twice the number of parts that the former was, it will be equally plain that the difference betwixt 1000 and the next mean proportional will be the measure of that element. Proceeding in like manner with the other numbers 1000 and 997, 1000 and 996, &c. it is evident, that by dividing into a proper number of parts, all the elements will be reduced to an equal degree of *fineness*, if we may so call it, and in calculations may be made use of without any fear of error.

19. The number of elementary parts being thus known which are contained in any proportion, it will be easy to find the ratios between those numbers which are in continued proportion to the first term of the series. Thus, having found the proportion between 1000 and 900,

we know also that of 1000 to 810, and 729;
And from 1000 to 800, also 1000 to 640, and to 512;
And from 1000 to 700, also 1000 to 490, and to 343;
And from 1000 to 600, also 1000 to 360, and to 216;
And from 1000 to 500, also 1000 to 250, and to 125.

Corol. Hence arises the precept for squaring, cubing, &c.; as also for extracting the square root, cube root, &c. out of the first figures of numbers. For it will be, As the greatest number of the chiliad as a denominator, is to the number proposed as a numerator, so is this to the square of the fraction, and so is this to the cube.

20. *Prop.* The proportion of a number to the first, or 1000, being known; if there be two other numbers in the same proportion to each other, then the proportion of one of these to 1000 being known, there will also be known the proportion of the other to the same 1000.

Corol. 1. Hence from the 15 proportions mentioned in prop. 18. will be known 120 others below 1000, to the same 1000.

For so many are the proportions, equal to some one or other of the said 15, that are among the other integer numbers which are less than 1000.

Corol. 2. Hence arises the method of treating the Rule-of-Three, when 1000 is one of the given terms.

For this is effected by adding to, or subtracting from, each other, the measures of the two proportions of 1000 to each of the other two given numbers, according as 1000 is, or is not, the first term in the Rule-of-three.

21. *Prop.* When four numbers are proportional, the first to the second as the third to the fourth, and the proportions of 1000 to each of the three former are known, there will also be known the proportion of 1000 to the fourth number.

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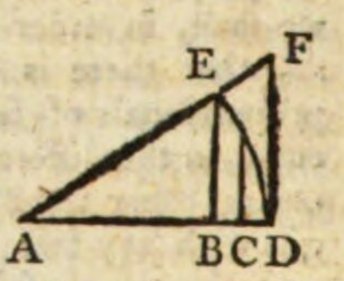
Corol. 1. By this means other chiliads are added to the former.

Corol. 2. Hence arises the method of performing the Rule-of-three, when 1000 is not one of the terms. Namely, from the sum of the measures of the proportions of 1000 to the second and third, take that of 1000 to the first, and the remainder is the measure of the proportion of 1000 to the fourth term.

Definition. The measure of the proportion between 1000 and any less number, as before described, and expressed by a number, is set opposite to that less number in the chiliad, and is called its *logarithm*, that is, the number (αριθμος) indicating the proportion (λογον) which 1000 bears to that number, to which the logarithm is annexed.

22. *Prop.* If the first or greatest number be made the radius of a circle, or *sinus totus*; every less number considered as the cosine of some arc, has a logarithm greater than the versed sine of that arc, but less than the difference between the radius and secant of the arc; except only in the term next after the radius, or greatest term, the logarithm of which by the hypothesis is made equal to the versed sine.

That is, if CD be made the logarithm of AC, or the measure of the proportion of AC to AD; then the measure of the proportion of AB to AD, that is, the logarithm of AB, will be greater than BD, but less than EF. And this is the same as Napier's first rule in page 44.



23. *Prop.* The same things being supposed; the sum of the versed sine and excess of the secant over the radius, is greater than double the logarithm of the cosine of an arc.

Corol. The logarithm cosine is less than the arithmetic mean between the versed sine and the excess of the secant.

Precept 1. Any sine being found in the canon of sines, and its defect below radius to the excess of the secant above radius; then shall the logarithm of the sine be less than half that sum, but greater than the said defect or coversed sine.

Let there be the sine 99970.1490 of an arc;
Its defect below radius is 29.8510 the covers. and less than logarithm sine;
Add the excess of the secant 29.8599

Sum 59.7109
its half or 29.8555 greater than the logarithm.

Therefore the logarithm is between { 29.8510 and 29.8555.

Precept 2. The logarithm of the sine being found, you will also find nearly the logarithm of the round or integer number which is next less than your sine with a fraction, by adding that fractional excess to the logarithm of the said sine.

Thus the logarithm of the sine 99970.149 is found to be about 29.854; if now the logarithm of the round number 99970,000 be required, add 149 the fractional part of the sine to its logarithm, observing the point, thus,

29.854
149 } is the logarithm of the round number 999700.000 nearly.
the sum 30.003

24. *Prop.* Of three equidifferent quantities, the measure

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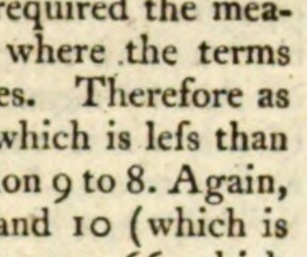
ſure of the proportion between the two greater terms, with the meaſure of the proportion between the two leſs terms, will conſtitute a proportion which will be greater than the proportion of the two greater terms, but leſs than the proportion of the two leaſt.

Thus if AB, AC, AD, be three quantities having the equal differences BC, CD; and if the meaſure of the proportion of AD, AC be cd, and that of AC, AB, be bc; then the proportion of cd to cb will be greater than the proportion of AC to AD, but leſs than the proportion of AB to AC.



25. *Prop.* The ſaid proportion between the two meaſures is leſs than half the proportion between the extreme terms: that is, the proportion between bc, cd, is leſs than half the proportion between AB, AD.

Corol. Since therefore the arithmetical mean divides the proportion into unequal parts, of which the one is greater and the other leſs than half the whole; if it be enquired what proportion is between theſe proportions, the anſwer is, that it is a little leſs than the ſaid half.

An example of finding nearly the limits, greater and leſs, to the meaſure of any propoſed proportion.—It being known that the meaſure of the proportion between 1000 and 900 is 10536.05, required the meaſure of the proportion 900 to 800, where the terms 1000, 900, 800, have equal differences. Therefore as 9 to 10, ſo 10536.05 to 11706.72, which is leſs than 11778.30, the meaſure of the proportion 9 to 8. Again, as the mean proportional between 8 and 10 (which is 8.9442719) is to 10, ſo 10536.05 to 11779.66, which is greater than the meaſure of the proportion between 9 and 8.

Axiom. Every number denotes an expreſſible quantity.

26. *Prop.* If the 1000 numbers, differing by 1, follow one another in the natural order, and there be taken any two adjacent numbers, as the terms of ſome proportion; the meaſure of this proportion will be to the meaſure of the proportion between the two greateſt terms of the chiliad, in a proportion greater than that which the greateſt term 1000 bears to the greater of the two terms firſt taken, but leſs than the proportion of 1000 to the leſs of the ſaid two ſelected terms.

So of the 1000 numbers taking any two ſucceſſive terms, as 501 and 500, the logarithm of the former being 69114.92, and of the latter 69314.72, the difference of which is 199.80. Wherefore by the definition, the meaſure of the proportion between 501 and 500 is 199.80. In like manner, becauſe the logarithm of the greateſt term 1000 is 0, and of the next 999 is 100.05, the difference of theſe logarithms, and the meaſure of the proportion between 1000 and 999, is 100.05. Couple now the greateſt term 1000 with each of the ſelected terms 501 and 500; couple alſo the meaſure 199.80 with the meaſure 100.05; ſo ſhall the proportion between 199.80 and 100.05 be greater than the proportion between 1000 and 501, but leſs than the proportion between 1000 and 500.

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Corol. 1. Any number below the firſt 1000 being propoſed, as alſo its logarithm; the differences of any logarithms antecedent to that propoſed, towards the beginning of the chiliad, are to the firſt logarithm (viz. that which is aſſigned to 999) in a greater proportion than 1000 to the number propoſed; but of thoſe which follow towards the laſt logarithm, they are to the ſame in a leſs proportion.

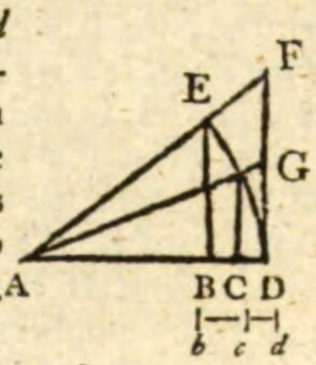
Corol. 2. By this means the places of the chiliad may eaſily be filled up, which have not yet had logarithms adapted to them by the former propoſitions.

27. *Prop.* The difference of two logarithms, adapted to two adjacent numbers, is to the difference of theſe numbers in a proportion greater than 1000 bears to the greater of thoſe numbers, but leſs than that of 1000 to the leſs of the two numbers.

This 27th propoſition is the ſame as Napier's ſecond rule.

28. *Prop.* Having given two adjacent numbers of the 1000 natural numbers, with their logarithmic indices, or the meaſures of the proportions which thoſe abſolute or round numbers conſtitute with 1000 the greateſt; the increments or differences of theſe logarithms will be to the logarithm of the ſmall element of the proportions, as the ſecants of the arcs whoſe coſines are the two abſolute numbers is to the greateſt number, or the radius of the circle: ſo that, however, of the ſaid two ſecants, the leſs will have to the radius a leſs proportion than the propoſed difference has to the firſt of all, but the greater will have a greater proportion, and ſo alſo will the mean proportional between the ſaid ſecants have a greater proportion.

Thus if BC, CD be equal, alſo *bd* the logarithm of AB, and *cd* the logarithm of AC; then the proportion of *bc* to *cd* will be greater than the proportion of AG to AD, but leſs than that of AF to AD, and alſo leſs than that of the mean proportional between AF and AG to AD.



Corol. 1. The ſame obtains alſo when the two terms differ, not only by the unit of the ſmall element, but by another unit which may be ten fold, a hundred fold, or a thouſand fold of that.

Corol. 2. Hence the differences will be obtained ſufficiently exact, eſpecially when the abſolute numbers are pretty large, by taking the arithmetical mean between two ſmall ſecants, or (if you will be at the labour) by taking the geometrical mean between two larger ſecants, and then by continually adding the differences, the logarithms will be produced.

Corol. 3. *Precept.* Divide the radius by each term of the aſſigned proportion, and the arithmetical mean (or ſtill nearer the geometrical mean) between the quotients will be the required increment, which being added to the logarithm of the greater term, will give the logarithm of the leſs term.

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EXAMPLE.

Let there be given the logarithm of 700, viz. 35667.4948, to find the logarithm to 699.

Here radius divided by 700 gives 1428571, &c.
and divided by 699 gives 1430672, &c.
the arithmetic mean is 142.962
which added to 35667.4948

gives the logarithm to 699 35810.4568

Corol. 4. *Precept* for the logarithms of fines.

The increment between the logarithms of two fines is thus found: find the geometrical mean between the cofecants, and divide it by the difference of the fines, the quotient will be the difference of the logarithms.

EXAMPLE.

0° 1′	fine 2909 cofec.	343774682
0 2	fine 5818 cofec.	171887319
	dif. 2909	geom. mean 2428 nearly.

The quotient 80000 exceeds the required increment of the logarithms, becaufe the fecants are here fo large.

Appendix. Nearly in the fame manner it may be fhown, that the fecond differences are in the duplicate proportion of the firft, and the third in the duplicate of the fecond. Thus, for inftance, in the beginning of the logarithms, the firft difference is 100.00000, viz. equal to the difference of the numbers 100000.00000 and 99900.00000; the fecond, or difference of the differences, 10000; the third 20. Again, after arriving at the number 50000.00000, the logarithms have for a difference 200.00000, which is to the firft difference as the number 100000.00000 to 50000.00000; but the fecond difference is 40000, in which 10000 is contained four times; and the third 328, in which 20 is contained fixteen times. But fince, in treating of new matters, we labour under the want of proper words, wherefore, left we fhould become too obfcure, the demonftration is omitted untried.

29. *Prop.* No number expreffes exactly the meafure of the proportion between two of the 1000 numbers conftituted by the foregoing method.

30. *Prop.* If the meafures of all proportions be expreffed by numbers or logarithms; all proportions will not have affigned to them their due portion of meafure, to the utmoft accuracy.

31. *Prop.* If to the number 1000, the greateft of the chiliad, be referred others that are greater than it, and the logarithm of 1000 be made 0, the logarithms belonging to thofe greater numbers will be negative.

This concludes the firft or fcientific part of the work; the principles of which Kepler applies, in the fecond part, to the actual conftruction of the firft 1000 logarithms, which is pretty minutely defcribed. This part is intitled *A very compendious method of conftructing the Chiliad of Logarithms*: and it is not improperly fo called, the method being very concife and eafy. The fundamental principles are briefly thefe: That at the beginning of the logarithms, their increments or differences are equal to thofe of the natural numbers: that the natural numbers may be confidered as the decreafing cofines of increafing arcs: and that the fecants of thofe arcs at the beginning have the fame differences as the cofines, and therefore the fame differences as the logarithms. Then, fince the fecants are the reciprocals of the cofines, by thefe principles and the third corol. to the twenty-eighth propofition, he eftablifhes the following method of conftituting the 100 firft or fmalleft logarithms to the 100 largeft numbers, 1000, 999, 998, 997, &c. to 900, viz. Divide the radius 1000, increafed with feven ciphers, by each of thefe numbers feparately, difpofing the quotients in a table, and they will be the fecants of thofe arcs which have the divifors for their cofines; continuing the divifion to the 8th figure, as it is in that place only that the arithmetical and geometrical means differ. Then, by adding fucceffively the arithmetical means between every two fucceffive fecants, the fums will be the feries of logarithms. Or, by adding continually every two fecants, the fucceffive fums will be the feries of the double logarithms.

Befides thefe 100 logarithms thus conftructed, he conftitutes two others by continual bifection or extractions of the fquare root, after the manner defcribed in the fecond poftulate. And firft he finds the logarithm which meafures the proportion between 100000.00 and 97656.25, which latter term is the third proportional to 1024 and 1000, each with two cyphers; and this is effected by means of twenty-four continual extractions of the fquare root, determining the greateft term of each of twenty-four claffes of mean proportionals; then the difference between the greateft of thefe means and the firft or whole number 1000, with ciphers, being as often doubled, there arifes 2371.6526 for the logarithm fought, which made negative is the logarithm of 1024. Secondly, the like proceis is repeated for the proportion between the numbers 1000 and 500, from which arifes 69314.7193 for the logarithm of 500; which he alfo calls the logarithm of duplication, being the meafure of the proportion of 2 to 1.

Then from the foregoing he derives all the other logarithms in the chiliad, beginning with thofe of the prime numbers 1, 2, 3, 5, 7, &c. in the firft 100. And firft, fince 1024, 512, 256, 128, 64, 32, 16, 8, 4, 2, 1, are all in the continued proportion of 1000 to 500, therefore the proportion of 1024 to 1 is decuple of the proportion of 1000 to 500, and confequently the logarithm of 1 would be decuple of the logarithm of 500, if 0 were taken as the logarithm of 1024; but fince the logarithm of 1024 is applied negatively, the logarithm of 1 muft be diminifhed by as much: diminifhing therefore 10 times the logarithm of 500, which is 693147.1928, by 2371.6526, the remainder 690775.5422 is the logarithm of 1, or of 100,00 what is fet down in the table.

Nos.	Logarithms.
100	230258.5141
10	460517.0282
1	690775.5422
.1	921034.0563
.01	1151292.5703
.001	1381551.0844
.0001	1611809.5985

And becaufe 1, 10, 100, 1000, are continued proportionals, therefore the proportion of 1000 to 1 is triple of the proportion of 1000 to 100, and confequently $\frac{1}{3}$ of the logarithm of 1 is to be put for the logarithm of 100, viz. 230258.5141, and this is alfo the logarithm of decuplication, or of the proportion of 10 to 1. And hence

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hence multiplying this logarithm of 100 ſucceſſively by 2, 3, 4, 5, 6, and 7, there ariſe the logarithms to the numbers in the decuple proportion, as under.

Alſo if the logarithm of duplication, or of the proportion of 2 to 1, be taken from the logarithm of 1, there will remain the logarithm of 2; and from the logarithm of 2 taking the logarithm of 10, there remains the logarithm of the proportion of 5 to 1; which taken from the logarithm of 1, there remains the logarithm of 5. See the margin.

Log. of 1	690775.5422
of 2 to 1	69314.7193
log. of 2	621460.8229
log. of 10	460517.0281
of 5 to 1	160943.7948
log. of 5	529831.7474

For the logarithms of other prime numbers, he has recourſe to thoſe of ſome of the firſt or greateſt century of numbers, before found, viz. of 999, 998, 997, &c. And firſt, taking 960, whoſe logarithm is 4082.2001; then by adding to this logarithm the logarithm of duplication, there will ariſe the ſeveral logarithms of all theſe numbers, which are in duplicate proportion continued from 960, namely 480, 240, 120, 60, 30, 15. Hence the logarithm of 30 taken from the logarithm of 10, leaves the logarithm of the proportion of 3 to 1; which taken from the logarithm of 1, leaves the logarithm of 3, viz. 580914.3106. And the double of this diminiſhed by the logarithm of 1, gives 4710, 53.0790 for the logarithm of 9.

Next, from the logarithm of 990, or $9 \times 10 \times 11$, which is 1005.0331, he finds the logarithm of 11; namely, ſubtract the ſum of the logarithms of 9 and 10 from the ſum of the logarithm of 990, and double the logarithm of 1, there remains 450986.0106 the logarithm of 11.

Again, from the logarithm of 980, or $2 \times 10 \times 7 \times 7$, which is 2020.2711, he finds 496184.5228 for the logarithm of 7.

And from 5129.3303 the logarithm of 950 or $5 \times 10 \times 19$, he finds 396331.6392 for the logarithm of 19.

In like manner the logarithm
to 998 or $4 \times 13 \times 19$, gives the logarithm of 13;
to 969 or $3 \times 17 \times 19$, gives the logarithm of 17;
to 986 or $2 \times 17 \times 29$, gives the logarithm of 29;
to 966 or $6 \times 7 \times 23$, gives the logarithm of 23;
to 930 or $3 \times 10 \times 31$, gives the logarithm of 31.

And ſo on for all the primes below 100, and for many of the primes in the other centuries up to 900. After which he directs to find the logarithms of all numbers compoſed of theſe, by the proper addition and ſubtraction of their logarithms, namely, in finding the logarithm of the product of two numbers, from the ſum of the logarithms of the two factors take the logarithm of 1, the remainder is the logarithm of the product. In this way he ſhows, that the logarithms of all numbers under 500 may be derived, except thoſe of the following 36 numbers, namely 127, 149, 167, 173, 179, 211, 223, 251, 257, 263, 269, 271, 277, 281, 283, 293, 337, 347, 349, 353, 359, 367, 373, 379, 383, 389, 397, 401, 409, 419, 421, 431, 433, 439, 443, 449. Alſo, beſides the compoſite numbers between 500 and 900, made up of the products of ſome numbers whoſe logarithms have been before determined, there will be 59 primes not compoſed of them; which with the 36 above mentioned make 95 numbers in all not compoſed of the products of any before them, and the logarithms of which he directs to be derived in this manner; namely, by conſidering the differences of the logarithms of the numbers interſperſed among them; then by that method by which were conſtituted the differences of the logarithms of the ſmalleſt 100 numbers in a continued ſeries, we are to proceed here in the diſcontinued ſeries, that is, by prop. 28th, corol. 3d, and eſpecially by the appendix to it, if it be rightly uſed, from whence thoſe differences will be very eaſily ſupplied.

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§ 3. *Mr Briggs's Method.*

The methods principally made uſe of by this gentleman were publiſhed in Napier's poſthumous work. Having ſuppoſed 0 to be the logarithm of 1, and 1 with any number of ciphers annexed, ſuppoſe 10 to be the logarithm of 10, this number is to be divided ten times by 5, which in a logarithmic number is equivalent to the extraction of the root of the fifth power; by which means he obtains the following numbers, viz. 2 with nine ciphers to it; 4 with eight ciphers; 8 with ſeven ciphers; 16 with ſix ciphers; 32 with five ciphers; 64 with four; 128000, 25600, 5120, and 1024. Dividing this laſt logarithm ten times by 2, we have a geometrical ſeries of ten numbers; the firſt of which is 512, and the laſt 1. Thus 20 logarithms are obtained: but the labour of finding the numbers belonging to them is ſo exceſſive, that it is ſurpriſing how it could be undergone by any body. To obtain thoſe correſponding to the firſt ten logarithms, the fifth root muſt be extracted ten times, and the ſquare root as often, to obtain the numbers correſponding to the others. The power from which theſe extractions is made, muſt originally be 1, with a number of ciphers annexed. Other logarithms might be formed from theſe by adding them, and multiplying their correſponding numbers; but as this method, beſides its exceſſive labour, would produce only an *antilogarithmic* canon like that of Mr Dodſon already mentioned, other more eaſy and proper methods were thought of.

The next was by finding continually geometrical means, firſt between 10 and 1, and then between 10 and that mean, and ſo on, taking the arithmetical means between their correſponding logarithms. The operation is alſo facilitated by various properties of numbers and their logarithms, as that the products and quotients of numbers correſpond to the ſums and differences of their logarithms; that the powers and roots of numbers anſwer to the products and quotients of the logarithms by the index of the power or root. Thus having the logarithm of 2, we can have thoſe of 4, 16, 256, &c. by multiplying the logarithms by 2, and ſquaring the numbers to as great an extent in that ſeries as we pleaſe. If we have alſo that of 3, we can not only have thoſe of 9, 81, 8561, &c. but of 6, 18. 27, and all poſſible products of the powers of 2 and 3 into one another, or into the numbers themſelves. The following property may alſo be of uſe, viz. that if the logarithms of any two numbers are given, and each number be raiſed to the power denoted by the index of the other, the products will be equal. Thus,

Log.	0	1	2	3	4	5	6
Nat. numb.	1	2	4	8	16	32	64

Let the two numbers be 4 and 16; it is plain, that if

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we raiſe 4 to the fourth power and 16 to the ſquare, the products will be the ſame; for 16×16 =256, and 4×4=16; 16×4=64; and 64×4=256.

Another method mentioned by Mr Briggs depends upon this property, that the logarithm of any number in this ſcale is 1 leſs than the number of places or figures contained in that power of that number whoſe exponent is the logarithm of 10, at leaſt as to integral numbers; for Mr Briggs has ſhown that they really differ by a fraction. To this Mr Hutton adds the following; *viz.* that of any two numbers, as the greater is to the leſs, ſo is the velocity of the increment or decrement of the logarithms at the greater; "that is (ſays he), in our modern notation, as X. Y : $y : x$; where x and y are the fluxions of X and Y.

In the treatiſe written upon the conſtruction of logarithms by Mr Briggs himſelf, he obſerves, that they may be conſtructed chiefly by the two methods already mentioned, concerning which he premiſes ſeveral lemmata concerning the powers of numbers and their indices, and how many places of figures are in the products of numbers. He obſerves, that theſe products will conſiſt of as many figures as there are in both factors, unleſs the firſt figures in each factor be expreſſed in one figure only, which ſometimes happens, and then there will commonly be one figure leſs in the product than in the two factors. He obſerves alſo, that if in any ſeries of geometricals, we take two terms, and raiſe one to the power denoted by the index of the other, or any number raiſed to the power denoted by the logarithm of the other, the product will be equal to this latter number raiſed to the power denominated by the logarithm of the former. Hence, if one of the numbers be 10, whoſe logarithm is 1 with any number of cyphers, then any number raiſed to the power whoſe index is the logarithm of that number, that is, the logarithm of any number in this ſcale where 1 is the logarithm of 10, is the index of that power of 10, which is equal to the given number. But the index of any integral power of 10 is one leſs than the number of places of figures it contains. Thus the ſquare of 10, or 100, contains three places of figures, which is more by one, than the index of the power; 1000, the cube of 10 contains four places, which is one more than the index, 3, of the power. Hence as the number of places of the powers of 10 are always exactly one more than the indices of thoſe powers, it follows that the places of figures in the powers of any other number which is no integral power of 10, will not always be exactly one leſs in number than the indices of the powers. From theſe two properties is deduced the following rule for finding the logarithms of many prime numbers.

Find the 10th, 100th, 1000th, or any other power of a number, ſuppoſe 2, with the number of places of figures in it, then that number of figures ſhall always exceed the logarithm of 2, although the exceſs will be conſtantly leſs than 1; whence by proceeding to very high powers we will at laſt be able to obtain the logarithm of the number to great exactneſs.

Thus, the logarithm of 2, found by other methods, is known to be 30102999566389, &c. The tenth power of 2 is 1024; which containing four places of figures, gives 4 for the logarithm of 2, which exceeds it, though not quite by 1. The 20th power of 2, conſiſting of the 10th power multiplied into itſelf, by its number of places ought to give the logarithm of 4; and according to the rule already laid down, ſhould contain eight places of figures: but by reaſon of the cipher which ſtands in the ſecond place, it is eaſy to ſee that it muſt contain only ſeven; which therefore gives ſeven for the logarithm of four. The logarithm of 16 is then expreſſed by the number of places of figures in the product of the 20th power of 2 into itſelf; and is therefore denominated by 13. That of 256 is denoted by the 80th power of 2, containing 25 places of figures. The logarithm of 2, therefore, having been already expreſſed by the 10th power of 2, will be again expreſſed by the 100th power. Adding, therefore, the number of places contained in the 80th power, *viz.* 25 to 7, the number of places contained in the 20th, we have 32 for the next expreſſion of that logarithm. On account of the cipher which ſtands in the ſecond place of one of the factors, however, we muſt deduct one from the number; and thus we have 31 for the logarithm of 2, which is a conſiderable approximation. Proceeding in this manner, at the 1000th power of 2, we have 302 for the logarithm of 2; at the 10,000th power we have 3011; at the 100,000th power, 30103; at the 1,000,000th, we have 301030; and at the 10,000,000th power, we obtain 3010300; which is as exact as is commonly expreſſed in the tables of logarithms; but by proceeding in the ſame manner we may have it to any degree of exactneſs we pleaſe. Thus, at the 100,000,000th power, we have 30103000; and at the 1,000,000,000th, the logarithm is 301029996, true to eight places of figures.

The only difficulty in this method is to find the number of places of figures in the different powers without multiplying them; but this may be determined by only multiplying the firſt five; or even the firſt three of the products will be ſufficient to determine this; and the logarithms may thus be found with very great facility.

When the logarithms, however, are required to a very great degree of exactneſs, our author thinks that the method of mean proportionals is moſt eligible. This conſiſts in finding a great number of mean proportionals betwixt 1 and the number propoſed; that is, firſt extracting the ſquare root of the number itſelf, then extracting the root of that root, &c. until the laſt root ſhall exceed 1 only by a very ſmall decimal. Finding then the logarithm of this number by methods hereafter to be deſcribed, he multiplies it by the index of the power of 2, denoted by the number of extractions of the ſquare root; and the reſult is the required logarithm of the given number. In this method, the number of decimal places contained in the laſt root ought to be double the number of true places required in the logarithm itſelf, and the firſt half of them ought to be cyphers; the integer being 1. To find out the firſt ſmall number and its logarithm, our author begins with 10 and its logarithm 1; continually extracting the root of the former, and biſecting the latter, till he comes to the 54th root, and then finds, that at the 53d and 54th roots both natural numbers and logarithms bear the ſame proportion to each other, viz. that of 2 to 1. Thus,

	Numbers.
53	1.00000,00000,00000,25563,82936,40064,70
54	1.00000,00000,00000,12781,91493,20032,35

1 Lo-

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	Logarithms.
53	0.00000 00000,00000,11102,23024,62515,65404
54	0.00000,00000,00000,05551,11512,31257,82702

If now by continual extraction and biſection we find any other ſmall number, it will then be, as 12781, &c. is to 5551, &c. ſo is that other ſmall decimal to the correſpondent ſignificant figures of its logarithm. To avoid, however, the exceſſive labour of ſuch long multiplications and diviſions, he reduces this ratio to another, the antecedent of which is 1. Thus, as 12781, &c. is to 5551, &c. ſo is 1 with as many ciphers annexed as precede the logarithms above mentioned, viz. 15, with another unit annexed to a 4th number, which will be the ſignificant figures of the logarithm of the third term. The proportions then will be 12781 &c. : 5551 &c. :: 1.00000,00000,00000, : 4342944819032 51804; this laſt number, with 17 ciphers prefixed, being the logarithm of the one immediately preceding it. Having therefore found by continual extraction any ſuch ſmall decimal as the above, multiply it by 4342, &c. and the product will be the correſponding logarithm of the laſt root.

Still, as the labour of ſo many extractions muſt be intolerably tedious, it became neceſſary to fall upon ſome contrivances to ſhorten ſuch operations; and of theſe the following is an example.

Let the number of which we ſeek the logarithm be involved to ſuch an height that the index of the power may be one, with either one or more ciphers next to it. Divide this power then by 1 with as many ciphers annexed as the power has ſignificant figures after the firſt; or, ſuppoſing all the figures after the firſt to be decimals, the roots are extracted continually from this power, till the decimal becomes ſufficiently ſmall, as when the firſt 15 places are ciphers; then, multiplying the decimal by 43429, &c. we have the logarithm of this laſt root; which logarithm, multiplied by the like power of the number 2, gives the logarithm of the firſt number of which the extraction was begun. To this logarithm if we prefix 1, 2, 3, &c. according as this number was found by dividing the power by 10, 100, 1000, &c. and laſtly, dividing the reſult by the index of that power, the quotient will be the required logarithm of the given prime number.

Thus to find by this method the logarithm of 2. Raiſe it firſt to the 10th power, which is 1024; then cutting off for decimals the laſt three figures, we continually extract the ſquare root from 1,024 forty-ſeven times, which gives 1.00000,00000,00000,16851,60570,53949,77; the decimal part of which multiplied by 43429, &c. gives 0.00000,00000,00000,07318,55936,90623,9368 for its logarithm, which being continually doubled 47 times, or multiplied at once by the 47th power of 2, viz. 140737488355328, gives for the logarithm of the number 10240.01029,99566,39811,95265,27744, true to 17 or 18 places of decimals; then prefixing to this number 3, becauſe the diviſion was made by 1000 (for cutting off the three places of decimals is the ſame as dividing by 1000), we have for the logarithm of 1024, 3.010299566, &c. as above. Laſtly, dividing by 10, becauſe 1024 is the 10th power of 2, we have the logarithm of 2 itſelf; viz. 0.30102, &c.

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The involving of any number to a very high power is by no means a matter of ſuch difficulty as might at firſt ſight be imagined. A number multiplied by itſelf produces the *ſquare*; the ſquare multiplied by itſelf produces the *biquadrate*; the biquadrate multiplied by itſelf gives the eighth power, and the eighth power multiplied by the ſquare produces the tenth. The tenth power multiplied by itſelf gives the 20th, and the 20th multiplied by itſelf the 40th. The eighth power divided by the original number gives the ſeventh; and the 40th power multiplied by the ſeventh gives the 47th power required.

The *differential* method of conſtructing logarithms was likewiſe invented by our author, and greatly ſhortens the labour of finding the mean proportionals. Mr Briggs, in the courſe of his calculations, had obſerved, that theſe proportionals, found by continual extraction of roots, gradually approach nearer and nearer to the halves of the preceding root; and that as many ſignificant figures as there are cyphers before them, agree exactly in this proportion. Subtracting therefore each of theſe decimal parts, which he called A, or the firſt differences, from half the next preceding one, and by comparing together the remainders or ſecond differences, called B, he found that the ſucceeding were always nearly equal to $\frac{1}{4}$ of the next preceding ones; then taking the difference between each ſecond difference and $\frac{1}{4}$ of the preceding one, he found that theſe third differences, called C, were nearly in the continual ratio of 8 to 1; again taking the difference between each C and $\frac{1}{8}$ of the next preceding, he found that theſe fourth differences, called D, were nearly in the continual ratio of 16 to 1; and ſo on, the 5th (E), 6th (F), &c. differences, being nearly in the continual ratio of 32 to 1, of 64 to 1, &c.: theſe plain obſervations being made, they very naturally and clearly ſuggeſted to him the notion and method of conſtructing all the remaining numbers from the differences of a few of the firſt, found by extracting the roots in the uſual way. This will evidently appear from the annexed ſpecimen of a few of the firſt numbers in the laſt example for finding the logarithm of 6; where after the 9th number the reſt are ſuppoſed to be conſtructed from the preceding differences of each, as here ſhown in the 10th and 11th. And it is evident that, in proceeding, the trouble will become always leſs and leſs; the differences gradually vaniſhing, till at laſt only the firſt differences remain. And that generally each leſs difference is ſhorter than the next greater, by as many places as there are cyphers at the beginning of the decimal in the number to be generated from the differences:

1,00776,96.

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	1,00776,96	
1	1,00387,72833,36962,45663,84655,1	
2	1,00193,67661,36946,61675,87022,9	
3	1,00096,79146,39099,01728,89072,0	
4	1,00048,38402,68846,62985,49253,5	A
5	1,00024,18908,78824,68563,80872,7	A
	24,19201,34423,31492,74626,7	½A
	292,55598,62928,93754,0	B
6	1,00012,09381,26397,13459,43919,4	A
	12,09454,39412,34281,90436,3	½A
	73,13015,20822,46516,9	B
	73,13899,65732,23438,5	¼B
	884,44909,76921,5	C
7	1,00006,04672,35055,30968,01600,5	A
	6,04690,63198,56729,71959,7	½A
	18,28143,25761,70359,2	B
	18,28253,80205,61629,2	¼B
	110,54443,91270,0	C
	110,55613,72115,2	⅛C
	1169,80845,2	D
8	1,00003,02331,60505,65775,96479,4	A
	3,02336,17527,65484,00800,2	½A
	4,57021,99708,04320,8	B
	4,57035,81440,42589,8	¼B
	13,81732,38269,0	C
	13,81805,48908,5	⅛C
	73,10639,7	D
	73,11302,8	1/16D
	663,1	E
9	1,00001,51164,65999,05672,95048,8	A
	1,51165,80252,82887,98239,7	½A
	1,14253,77215,03190,9	B
Hitherto the	1,14255,49927,01080,2	¼B
smaller differences	1,72711,97889,3	C
are found by sub-	1,72716,54783,6	⅛C
tracting the larger from	4,56894,3	D
the parts of the like pre-	4,56915,0	1/16D
ceding ones.	20,7	E
	20,7	1/32E
Here the greater differences	65	1/32E
remain after subtracting	28555,89	1/16D
the smaller from the parts	28555,24	D
of the difference of	21588,99736,16	⅛C
the next preceding	21588,71180,92	C
number.	28563,44303,75797,72	¼B
	28563,22715,04616,80	B
	75582,32999,52836,47524,40	½A
10	1,00000,75582,04436,30121,42907,60	A
	2	1/32E
	1784,70	1/16D
	1784,68	D
	2698,58897,62	⅛C
	2698,57112,94	C
	7140,80678,76154,20	¼B
	7140,77980,19041,26	B
	37791,02218,15060,71453,80	½A
11	1,00000,37790,95077,37080,52412,54	A

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He then concludes this chapter with an ingenious, but not obvious, method of finding the differences B, C, D, E, &c. belonging to any number, as suppose the 9th, from that number itself, independent of any of the preceding 8th, 7th, 6th, 5th, &c.; and it is this: Raise the decimal A to the 2d, 3d, 4th, 5th, &c. powers; then will the 2d (B), 3d (C), 4th (D), &c. differences be as here below, viz.

$B = \frac{1}{2}A^2$,

$C = .\frac{1}{2}A^3 + \frac{1}{8}A^4$,

$D = . . \frac{7}{8}A^4 + \frac{7}{8}A^5 + \frac{7}{16}A^6 + \frac{1}{8}A^7 + \frac{1}{64}A^8$,

$E = . . . 2\frac{5}{8}A^5 + 7A^6 + 10\frac{15}{16}A^7 + 12\frac{69}{128}A^8 + 11\frac{11}{64}A^9 + 7\frac{105}{128}A^{10}$,

$F = ... 13\frac{9}{16}A^6 + 81\frac{3}{8}A^7 + 296\frac{87}{128}A^8 + 834\frac{43}{128}A^9 + 1953\frac{285}{512}A^{10}$, &c.

$G = ... 122\frac{1}{16}A^7 + 1510\frac{67}{128}A^8 + 11475\frac{73}{128}A^9 + 68372\frac{79}{1024}A^{10}$, &c.

$H = ... 1937\frac{95}{128}A^8 + 47151\frac{93}{128}A^9 + 706845\frac{1493}{1024}A^{10}$, &c.

$I = ... 54902\frac{89}{128}A^9 + 2558465\frac{2357}{4096}A^{10}$, &c.

$K = ... 2805527A^{10}$, &c.

&c.

Thus in the 9th number of the foregoing example, omitting the ciphers at the beginning of the decimals, we have

$A = 1,51164,65999,05672,95048,8$

$A^2 = 2,28507,54430,06381,6726$

$A^3 = 3,45422,65239,48546,2$

$A^4 = 5,22156,97802,288$

$A^5 = 7,89316,8205$

$A^6 = 11,93168,1$

&c.

Consequently

$A^{\frac{1}{2}^2} = 1,14253,77215,03190,8363 = B$

$\frac{1}{2}A^3$ - 1,72711,32619,74273

$\frac{1}{8}A^4$ - - - 65269,62225

$\frac{1}{2}A^3 + \frac{1}{8}A^4$ 1,72711,97889,36498 $= C$

$\frac{7}{8}A^4$ 4,56887,35577

$\frac{7}{8}A^5$ - - 6,90652

$\frac{7}{16}A^6$ - - - - 5

$\frac{7}{8}A^4 + \frac{7}{8}A^5 + \frac{7}{16}A^6$ 4,56894,26234 $= D$

$2\frac{5}{8}A^5$ - - 20,71957

$7A^6$ - - - 83

$2\frac{5}{8}A^5 + 7A^6$ - - - 20,72040 $= E$

which agree with the like differences in the foregoing specimen.

§ 4. *Of Curves related to Logarithms.*

Several other ingenious methods and improvements are laid down by our author in his treatise upon this subject; but as all these were attended with great labour, mathematicians still continued their efforts to facilitate the work; and it was soon perceived that some curves had properties analogous to logarithms. Edmund Gunter, it has been said, first gave the idea of a curve, whose abscisses are in arithmetical progression, while the corresponding ordinates are in geometrical progression, or whose abscisses are the logarithms of their ordinates; but it is not noticed in any part of his writings. The same curve was afterwards considered

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considered by others, and named the *logarithmic* or *logistic* curve by Huygens in his *Dissertatio de Causa Gravitatis*, where he enumerates all the principal properties of this curve, showing its analogy to logarithms. Many other learned men have also treated of its properties; particularly Le Seur and Jacquier in their comment on Newton's Principia; Dr John Kiell in the elegant little tract on logarithms subjoined to his edition of Euclid's Elements; and Francis Maseres, Esq; cursitor baron of the exchequer, in his ingenious treatise on Trigonometry; in which books the doctrine of logarithms is copiously and learnedly treated, and their analogy to the logarithmic curve, &c. fully displayed. It is indeed rather extraordinary that this curve was not sooner announced to the public; since it results immediately from Baron Napier's manner of conceiving the generation of logarithms, by only supposing the lines which represent the natural numbers to be placed at right angles to that upon which the logarithms are taken. This curve greatly facilitates the conception of logarithms to the imagination, and affords an almost intuitive proof of the very important property of their fluxions, or very small increments, *viz.* that the fluxion of the number is to the fluxion of the logarithm, as the number is to the subtangent; as also of this property, that, if three numbers be taken very nearly equal, so that their ratios to each other may differ but a little from a ratio of equality; as for example, the 3 numbers 10,000,000, 10,000,001, 10,000,002, their differences will be very nearly proportional to the logarithms of the ratios of those numbers to each other: all which follows from the logarithmic arcs being very little different from their chords, when they are taken very small. And the constant subtangent of this curve is what was afterwards by Cotes called the *modulus* of the system of logarithms: and since, by the former of the two properties above mentioned, this subtangent is a fourth proportional to the fluxion of the number, the fluxion of the logarithm, and the number, this property afforded occasion to Mr Baron Maseres to give the following definition of the *modulus*, which is the same in effect as Cotes's, but more clearly expressed; namely, that it is the limit of the magnitude of a fourth proportional to these three quantities, *viz.* the difference of any two natural numbers that are very nearly equal to each other, either of the said numbers and the logarithm or measure of the ratio they have to each other. Or we may define the *modulus* to be the natural number at that part of the system of logarithms, where the fluxion of the number is equal to the fluxion of the logarithm, or where the numbers and logarithms have equal differences. And hence it follows, that the logarithms of equal numbers or of equal ratios, in different systems, are to one another as the *moduli* of those systems. Moreover, the ratio whose measure or logarithm is equal to the *modulus*, and thence by Cotes called the *ratio modularis*, is by calculation found to be the ratio of 2·7182818284 59, &c. to 1, or of 1 to ·3678794411 71, &c.: the calculation of which number may be seen at full length in Mr Baron Maseres's treatise on the Principles of Life-annuities, p. 274 and 275.

The hyperbolic curve also afforded another source for developing and illustrating the properties and construction of logarithms. For the hyperbolic areas lying between the curve and one asymptote, when they are bounded by ordinates parallel to the other asymptote, are analogous to the logarithms of their abscisses or parts of the asymptote. And so also are the hyperbolic sectors; any sector bounded by an arc of the hyperbola and two radii being equal to the quadrilateral space bounded by the same arc, the two ordinates to either asymptote from the extremities of the arc and the part of the asymptote intercepted between them. And although Napier's logarithms are commonly said to be the same as hyperbolic logarithms, it is not to be understood that hyperbolas exhibit Napier's logarithms only, but indeed all other possible systems of logarithms whatever. For, like as the right-angled hyperbola, the side of whose square inscribed at the vertex is 1, gives us Napier's logarithms; so any other system of logarithms is expressed by the hyperbola whose asymptotes form a certain oblique angle, the side of the rhombus inscribed at the vertex of the hyperbola in this case also being still 1, the same as the side of the square in the right-angled hyperbola. But the areas of the square and rhombus, and consequently the logarithms of any one and the same number or ratio, will differ according to the sine of the angle of the asymptotes. And the area of the square or rhombus, or any inscribed parallelogram, is also the same thing as what was by Cotes called the *modulus of the system of logarithms*; which modulus will therefore be expressed by the numerical measure of the sine of the angle formed by the asymptotes, to the radius 1; as that is the same with the number expressing the area of the said square or rhombus, the side being 1: which is another definition of the modulus to be added to those we before remarked above in treating of the logarithmic curve. And the evident reason of this is, that in the beginning of the generation of these areas from the vertex of the hyperbola, the nascent increment of the abscisse drawn into the altitude 1, is to the increment of the area, as radius is to the sine of the angle of the ordinate and abscisse, or of the asymptotes; and at the beginning of the logarithms, the nascent increment of the natural numbers is to the increment of the logarithms as 1 is to the modulus of the system. Hence we easily discover, that the angle formed by the asymptotes of the hyperbola, exhibiting Briggs's System of Logarithms, will be 25° 44′ 25½″; this being the angle whose sine is 0·4342944819, &c. the modulus of this system.

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Or indeed any one hyperbola, as has been remarked by Mr Baron Maseres, will express all possible systems of logarithms whatever; namely, if the square or rhombus inscribed at the vertex, or, which is the same thing, any parallelogram inscribed between the asymptotes and the curve at any other point, be expounded by the modulus of the system; or, which is the same, by expounding the area, intercepted between two ordinates which are to each other in the ratio of 10 to 1, by the logarithm of that ratio in the proposed system.

As to the first remarks on the analogy between logarithms and the hyperbolic spaces; it having been shown by Gregory St Vincent, in his *Quadratura Circuli et Sectionum Coni*, published at Antwerp in 1647, that if one asymptote be divided into parts in geometrical progression, and from the points of division ordinates

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dinates be drawn parallel to the other aſymptote, they will divide the ſpace between the aſymptote and curve into equal portions; from hence it was ſhown by Merſennus, that, by taking the continual ſums of thoſe parts, there would be obtained areas in arithmetical progreſſion, adapted to abſciſſes in geometrical progreſſion, and which therefore were analogous to a ſyſtem of logarithms. And the ſame analogy was remarked and illuſtrated ſoon after by Huygens and many others, who ſhow how to ſquare the hyperbolic ſpaces by means of the logarithms. There are likewiſe many other geometrical figures which have properties analogous to logarithms; ſuch as the equiangular ſpiral, the figures of the tangents and ſecants, &c.

§ 5. *Mercator's Method.*

This is purely arithmetical, and is founded upon the idea of logarithms already mentioned; *viz.* that they are the meaſures of ratios, and expreſs the number of *ratiunculæ* contained in any ratio into which it may be divided. Having ſhown then that theſe logarithms, or numbers of ſmall ratios, or meaſures of ratios, may be all properly repreſented by numbers; and that of 1, or the ratio of equality, the logarithm or meaſure being always 0, the logarithm of 10, or the meaſure of the ratio of 10 to 1, is moſt conveniently repreſented by 1 with any number of ciphers; he then proceeds to ſhow how the meaſures of all other ratios may be found from this laſt ſuppoſition. And he explains the principles by the two following examples.

Firſt, to find the logarithm of 100·5, or to find how many *ratiunculæ* are contained in the ratio of 1005 to 1, the number of *ratiunculæ* in the decuple ratio, or ratio of 10 to 1, being 10,000,000.

The given ratio 100·5 to 1 he firſt divides into its parts; namely, 100·5 to 100, 100 to 10, and 10 to 1; the laſt two of which being decuples, it follows that the characteriſtic will be 2, and it only remains to find how many parts of the next decuple belong to the firſt ratio of 100·5 to 100. Now if each term of this ratio be multiplied by itſelf, the products will be in the duplicate ratio of the firſt terms, or this laſt ratio will contain a double number of parts; and if theſe be multiplied by the firſt terms again, the ratio of the laſt products will contain three times the number of parts, and ſo on; the number of times of the firſt parts contained in the ratio of any like powers of the firſt terms, being always denoted by the exponent of the power. If therefore the firſt terms 100·5 and 100 be continually multiplied till the ſame powers of them have to each other a ratio whoſe meaſure is known; as ſuppoſe the decuple ratio 10 to 1, whoſe meaſure is 10,000,000: then the exponent of that power ſhows what multiple this meaſure 10,000,000 of the decuple ratio is of the required meaſure of the firſt ratio 100·5 to 100; and conſequently dividing 10,000,000 by that exponent, the quotient is the meaſure of the ratio 100·5 to 100 ſought. The operation for finding this he ſets down as here follows; where the ſeveral multiplications are all performed in the contracted way by inverting the figures of the multiplier, and retaining only the firſt number of decimals in each product.

				Power.
100·5000	-	-	-	1
5001	-	-	-	1
1005000				
5025				
1010025	-	-	-	2
5200101	-	-	-	2
1010025				
10100				
20				
5				
1020150	-	-	-	4
0510201	-	-	-	4
1020150				
20403				
102				
51				
1040706	-	-	-	8
6070401	-	-	-	8
1083068	-	-	-	16
8603801	-	-	-	16
1173035	-	-	-	32
5303711	-	-	-	32
1376011	-	-	-	64
1106731	-	-	-	64
1893406	-	-	-	128
6043981	-	-	-	128
3584985	-	-	-	256
5894853	-	-	-	256
12852116	-	-	-	512

This power being greater than the decuple of the like power of 100, which muſt always be 1 with ciphers, reſume therefore the 256th power, and multiply it not by itſelf but by the next before it, *viz.* by the 128th, thus,

				Power.
3584985	-	-	-	256
6043981	-	-	-	128
6787831	-	-	-	384
1106731	-	-	-	64
9340130	-	-	-	448
5303711	-	-	-	32
10956299	-	-	-	480

This power again exceeding the ſame power of 100 more than 10 times, he therefore draws the ſame 448th not into the 32d but the next preceding, thus,

				Power.
9340130	-	-	-	448
8603801	-	-	-	16
10115994	-	-	-	464

This being again too much, inſtead of the 16th draw it into the 8th or next preceding, thus,

				Power.
9340130	-	-	-	448
6070401	-	-	-	8
9720329	-	-	-	456
0510201	-	-	-	4
9916193	-	-	-	460
5200101	-	-	-	2
10015603	-	-	-	462

Which

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Which power again exceeds the limit: therefore draw the 460th into the 1st, thus,

	Power.
9916193 - - -	460
5001 - - -	1
9965774 - - -	461

Since therefore the 462d power of 100·5 is greater, and the 461st power is less, than the decuple of the same power of 100; he finds that the ratio of 100·5 to 100 is contained in the decuple more than 461 times, but less than 462 times. Again,

Since the { 460, 461, 462 } power is { 9916193, 9965774, 10015603 } and the differences { 49581, 49829 } { nearly equal;

therefore the proportional part which the exact power, or 10000000, exceeds the next less 9965774, will be easily and accurately found by the Golden Rule, thus:

The just power - -	10000000
and the next less - -	9965774
the difference - -	34226; then,

As 49829 the dif. between the next less and greater,
: To 34226 the dif. between the next less and just,
:: So is 10000: to 6868, the decimal parts; and therefore the ratio of 100·5 to 100, is 461·6868 times contained in the decuple or ratio of 10 to 1. Dividing now 1,0000000, the measure of the decuple ratio, by 461.6868, the quotient 00216597 is the measure of the ratio of 100·5 to 100; which being added to 2, the measure of 100 to 1, the sum 2,00216597 is the measure of the ratio of 100·5 to 1, that is, the log. of 100·5 is 2,00216597.

In the same manner he next investigates the log. of 99·5, and finds it to be 1,99782307.

A few observations are then added, calculated to generalize the consideration of ratios, their magnitude and affections. It is here remarked, that he considers the magnitude of the ratio between two quantities as the same, whether the antecedent be the greater or the less of the two terms; so the magnitude of the ratio of 8 to 5 is the same as of 5 to 8; that is, by the magnitude of the ratio of either to the other is meant the number of *ratiuncula* between them, which will evidently be the same whether the greater or less term be the antecedent. And he farther remarks, that of different ratios, when we divide the greater term of each ratio by the less, that ratio is of the greater mass or magnitude which produces the greater quotient, *et vice versa*; although those quotients are not proportional to the masses or magnitudes of the ratios. But when he considers the ratio of a greater term to a less, or of a less to a greater, that is to say, the ratio of greater or less inequality, as abstracted from the magnitude of the ratio, he distinguishes it by the word *affection*, as much as to say greater or less affection, something in the manner of positive and negative quantities, or such as are affected with the signs + and — . . . . . The remainder of this work he delivers in several propositions, as follows:

Prop. 1. In subtraction from each other two quantities of the same affection, to wit, both positive, or both negative; if the remainder be of the same affection with the two given, then is the quantity subtracted the less of the two, or expressed by the less number; but if the contrary, it is the greater.

Prop. 2. In any continued ratios, as $\frac{a}{a+b}, \frac{a+b}{a+2b}, \frac{a+2b}{a+3b}$, &c. (by which is meant the ratios of a to $a+b$, $a+b$ to $a+2b$, $a+2b$ to $a+3b$, &c.) of equidifferent terms, the antecedent of each ratio being equal to the consequent of the next preceding one, and proceeding from less terms to greater; the measure of each ratio will be expressed by a greater quantity than that of the next following; and the same through all their orders of differences, namely, the 1st, 2d, 3d, &c. differences; but the contrary, when the terms of the ratios decrease from greater to less.

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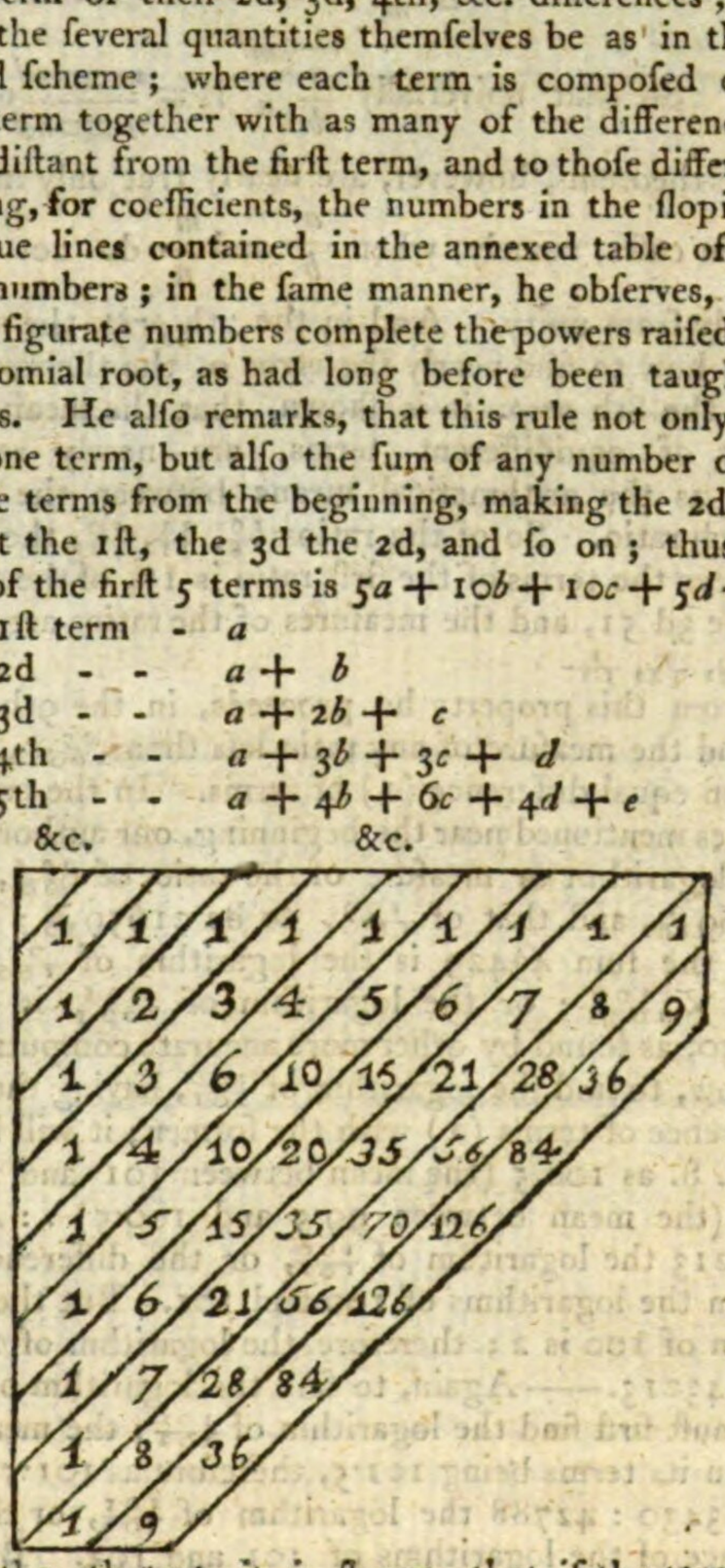
Prop. 3. In any continued ratios of equidifferent terms, if the 1st or least be a, the difference between the 1st and 2d b, and c, d, e, &c. the respective first term of their 2d, 3d, 4th, &c. differences; then shall the several quantities themselves be as in the annexed scheme; where each term is composed of the first term together with as many of the differences as it is distant from the first term, and to those differences joining, for coefficients, the numbers in the sloping or oblique lines contained in the annexed table of figurate numbers; in the same manner, he observes, as the same figurate numbers complete the powers raised from a binomial root, as had long before been taught by others. He also remarks, that this rule not only gives any one term, but also the sum of any number of successive terms from the beginning, making the 2d coefficient the 1st, the 3d the 2d, and so on; thus, the sum of the first 5 terms is $5a + 10b + 10c + 5d + e$.

1st term -	a
2d - -	$a + b$
3d - -	$a + 2b + c$
4th - -	$a + 3b + 3c + d$
5th - -	$a + 4b + 6c + 4d + e$
&c.	&c.



In the 4th *prop.* it is shown, that if the terms decrease, proceeding from the greater to the less, the same theorems hold good, by only changing the sign of every other term, as below.

1st term - -	a
2d - - -	$a - b$
3d - - -	$a - 2b + c$
4th - - -	$a - 3b + 3c - d$
5th - - -	$a - 4b + 6c - 4d + e$
&c.	&c.

Prop. 6th and 7th, treat of the approximate multiplication and division of ratios, or, which is the same thing, the finding nearly any powers or any roots of a given fraction, in an easy manner. The theorem for raising

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raising any power, when reduced to a simpler form, is this, the m power of $\frac{a}{b}$, or $\left|\frac{a}{o}\right|^m$ is $= \frac{s \mp md}{s \pm md}$ nearly, where s is $= a + b$, and $d = a \sim b$, the sum and difference of the two numbers, and the upper or under signs take place according as $\frac{a}{b}$ is a proper or an improper fraction, that is, according as a is less or greater than b. And the theorem for extracting the mth root of $\frac{a}{b}$ is $\sqrt[m]{\frac{a}{b}}$ or $\left|\frac{a}{b}\right|^{\frac{1}{m}} = \frac{ms \mp d}{ms \pm d}$ nearly; which latter rule is also the same as the former, as will be evident by substituting $\frac{1}{m}$ instead of m in the first theorem. So that universally $\left|\frac{a}{b}\right|^{\frac{m}{n}}$ is $= \frac{ns \mp md}{ns \pm md}$ nearly. These theorems, however, are nearly true only in some certain cases, namely, when $\frac{a}{b}$ and $\frac{m}{n}$ do not differ greatly from unity. And in the 7th *prop.* the author shows how to find nearly the error of the theorems.

In the 8th *prop.* it is shown, that the measures of ratios of equidifferent terms, are nearly reciprocally as the arithmetical means between the terms of each ratio. So of the ratios $\frac{16}{18}$, $\frac{33}{35}$, $\frac{50}{52}$, the mean between the terms of the first ratio is 17, of the 2d 34, of the 3d 51, and the measures of the ratios are nearly as $\frac{1}{17}$, $\frac{1}{34}$, $\frac{1}{51}$.

From this property he proceeds, in the 9th prop. to find the measure of any ratio less than $\frac{99.5}{100}$, which has an equal difference (1) of terms. In the two examples mentioned near the beginning, our author found the logarithm or measure of the ratio, of $\frac{99.5}{100}$, to be $21769\frac{3}{10}$, and that of $\frac{100}{100.5}$ to be $21659\frac{7}{10}$; therefore the sum 43429 is the logarithm of $\frac{99.5}{100.5}$, or $\frac{99.5}{100} \times \frac{100}{100.5}$; or the logarithm of $\frac{99.5}{100.5}$ is nearer 43430, as found by other more accurate computations. ---Now, to find the logarithm of $\frac{100}{101}$, having the same difference of terms (1) with the former; it will be, by prop. 8. as 100.5 (the mean between 101 and 100): 100 (the mean between 99·5 and 100·5) : : 43430 : 43213 the logarithm of $\frac{100}{101}$, or the difference between the logarithms of 100 and 101. But the logarithm of 100 is 2; therefore the logarithm of 101 is 2,0043213.——Again, to find the logarithm of 102, we must first find the logarithm of $\frac{101}{102}$; the mean between its terms being 101·5, therefore as 101·5 : 100 : : 43430 : 42788 the logarithm of $\frac{101}{102}$, or the difference of the logarithms of 101 and 102. But the logarithm of 101 was found above to be 2,0043213; therefore the logarithm of 102 is 2,0086001.---So that dividing continually 868596 (the double of 434298 the logarithm of $\frac{99.5}{100.5}$ or $\frac{199}{201}$) by each number of the series 201, 203, 205, 207, &c. then add 2 to the 1st quotient, to the sum add the 2d quotient, and so on, adding always the next quotient to the last sum, the several sums will be the respective logarithms of the numbers in this series, 101, 102, 103, 104, &c.

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The next, or prop. 10th, shows that, of two pair of continued ratios, whose terms have equal differences, the difference of the measures of the first two ratios is to the difference of the measures of the other two, as the square of the common term in the two latter is to that in the former, nearly. Thus, in the four ratios $\frac{a}{a+b}$, $\frac{a+b}{a+2b}$, $\frac{a+3b}{a+4b}$, $\frac{a+4b}{a+5b}$, as the measure of $\frac{aa+2ab}{a+b^2}$ (the difference of the first two, or the quotient of the two fractions): the measure of $\frac{aa+8ab+15bb}{a+4b^2}$: : $\overline{a+4b}^2$: $\overline{a+b}^2$, nearly.

In *prop.* 11. the author shows that similar properties take place among two sets of ratios, consisting each of 3 or 4, &c. continued numbers.

Prop. 12. shows, that of the powers of numbers in arithmetical progression, the orders of differences which become equal, are the second differences in the squares, the 3d differences in the cubes, the 4th differences in the 4th powers, &c. And from hence it is shown, how to construct all those powers by the continual addition of their differences: As had been long before more fully explained by Briggs.

In the next, or 13th *prop.* our author explains his compendious method of raising the tables of logarithms, showing how to construct the logarithms by addition only, from the properties contained in the 8th, 9th, and 12th propositions. For this purpose he makes use of the quantity $\frac{a}{b-c}$, which by division he resolves into this infinite series $\frac{a}{b} + \frac{ac}{bb} + \frac{ac^2}{b^3} + \frac{ac^3}{b^4}$, &c. *(in infin.)* Putting then $a = 100$ the arithmetical mean between the terms of the ratio $\frac{99.5}{100.5}$, $b = 100000$, and c successively equal to 0·5, 1·5, 2·5, &c. that so $b-c$ may be respectively equal to 99999·5, 99998·5, 99997·5, &c. the corresponding means between the terms of the ratios $\frac{99999}{100000}$, $\frac{99998}{99999}$, $\frac{99997}{99998}$, &c. it is evident that $\frac{a}{b-c}$ will be the quotient of the 2d term divided by the 1st in the proportions mentioned in the 8th and 9th propositions; and when each of these quotients are found, it remains then only to multiply them by the constant 3d term 43429, or rather 43429·8, of the proportion, to produce the logarithms of the ratios $\frac{99999}{100000}$, $\frac{99998}{99999}$, $\frac{99997}{99998}$, &c. till $\frac{10000}{10001}$; then adding these continually to 4 the logarithm of 10000 the least number, or subtracting them from 5 the logarithm of the highest term 100000, there will result the logarithms of all the absolute numbers from 10000 to 100000. Now when c is $= 0.5$, then

$\frac{a}{b} = .001$, $\frac{ac}{bb} = .000000005$, $\frac{ac^2}{b^3} = .000000000000025$, $\frac{ac^3}{b^4} = .000000000000000000125$,

&c.; therefore $\frac{a}{b-c} = \frac{a}{b} + \frac{ac}{bb} + \frac{ac^2}{b^3}$, &c. is $= .001000005000025000125$,

In like manner, if $c = 1.5$, then $\frac{a}{b+c}$ will be $= .001000015000225003375$;

and if $c = 2.5$, then $\frac{a}{b-c}$ will be $= .001000025000625015625$;

&c.

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&c. But instead of constructing all the values of $\frac{a}{b-c}$ in the usual way of raising the powers, he directs them to be found by addition only, as in the last proposition. Having thus found all the values of $\frac{a}{b-c}$, the author then shows, that they may be drawn into the constant logarithm 43429 by addition only, by the help of the annexed table of the first 9 products of it.

1	43429
2	86858
3	130287
4	173716
5	217145
6	260574
7	304003
8	347432
9	390861

The author then distinguishes which of the logarithms it may be proper to find in this way, and which from their component parts. Of these the logarithms of all even numbers need not be thus computed, being composed from the number 2; which cuts off one half of the numbers: neither are those numbers to be computed which end in 5, because 5 is one of their factors; these last are $\frac{1}{10}$ of the numbers; and the two together $\frac{1}{2}+\frac{1}{10}$ make $\frac{3}{5}$ of the whole: and of the other $\frac{2}{5}$, the $\frac{2}{3}$ of them, or $\frac{4}{15}$ of the whole, are composed of 3; and hence $\frac{3}{5}+\frac{2}{15}$, or $\frac{11}{15}$ of the numbers, are made up of such as are composed of 2, 3, and 5. As to the other numbers which may be composed of 7, of 11, &c.; he recommends to find their logarithms in the general way, the same as if they were incomposites, as it is not worth while to separate them in so easy a mode of calculation. So that of the 90 chiliads of numbers from 10000 to 100000, only 24 chiliads are to be computed. Neither indeed are all of these to be calculated from the foregoing series for $\frac{a}{b-c}$, but only a few of them in that way, and the rest by the proportion in the 8th proposition. Thus, having computed the logarithms of 10003 and 10013, omitting 10023 as being divisible by 3, estimate the logarithms of 10033 and 10043, which are the 30th numbers from 10003 and 10013; and again, omitting 10053, a multiple of 3, find the logarithms of 10063 and 10073. Then by prop. 8.

As 10048, the arithmetical mean between 10033 and 10063,
to 10018, the arithmetical mean between 10003 and 10033,
so 13006, the difference between the logarithms of 10003 and 10033,
to 12967, the difference between the logarithms of 10033 and 10063;

That is, 1st As $\left\{\begin{matrix}10048\\10078\\10108\end{matrix}\right\}$: 10018 : : 13006 : $\left\{\begin{matrix}12967\\\&c.\end{matrix}\right.$

Again, As $\left\{\begin{matrix}10058\\10088\\10118\end{matrix}\right\}$: 10028 : : 12992 : $\left\{\begin{matrix}12953\\\&c.\end{matrix}\right.$

And 3dly, As $\left\{\begin{matrix}10068\\10098\\\&c.\end{matrix}\right\}$: 10038 : : 12979 : $\left\{\begin{matrix}12940\\\&c.\end{matrix}\right.$

And with this our author concludes his compendium for constructing the tables of logarithms.

§ 6. *Gregory's Method.*

This is founded upon an analogy between a scale of logarithmic tangents and Wright's protraction of the nautical meridian line consisting of the sums of the secants. It is not known by whom this discovery was made; but, about 1645, it was published by Mr Henry Bond, who mentions this property in Norwood's Epitome of Navigation. The mathematical demonstration of it was first investigated by Mercator; who, with a view to make some advantage of his discovery, offered, in the Philosophical Transactions for June 4th 1666, to lay a wager with any one concerning it; but this proposal not being accepted, the demonstration was not published. Other mathematicians, however, soon found out the mystery; and in two years after, Dr Gregory published a demonstration, and from this and other similar properties he showed a method of computing the logarithmic sines and tangents by means of an infinite series. Several of these were invented by him, and the method of applying them laid down by himself and others; but Mr Hutton thinks that a shorter and better method than any they proposed might have been found by computing, by means of the series, only a few logarithms of small ratios, in which the terms of the series would have decreased by the powers of 10 or some greater number, the numerators of all the terms being unity, and their denominators the powers of 10 or some greater number, and then employing these few logarithms, so computed, to the finding of the logarithms of other and greater ratios by the easy operations of mere addition and subtraction. This might have been done for the logs. of the ratios of the first ten numbers, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, to 1, in the following manner, communicated by Mr Baron Maseres.—In the first place the logarithm of the ratio of 10 to 9, or of 1 to $\frac{9}{10}$, or of 1 to $1-\frac{1}{10}$, is equal to the series $\frac{1}{10}+\frac{1}{2\times100}+\frac{1}{3\times1000}+\frac{1}{4\times10000}+\frac{1}{5\times100000}$ &c. In like manner are easily found the logarithms of the ratios of 11 to 10; and then by the same series those of 121 to 120, and of 81 to 80, and of 2401 to 2400; in all which cases the series would converge still faster than in the two first cases. We may then proceed by mere addition and subtraction of logarithms, as follows.

Log. $\frac{11}{9}$ = L. $\frac{11}{10}$ + L. $\frac{10}{9}$,
L. $\frac{121}{81}$ = 2L. $\frac{11}{9}$,
L. $\frac{121}{80}$ = L. $\frac{121}{81}$ + L. $\frac{81}{80}$,
L. $\frac{120}{80}$ = L. $\frac{121}{80}$ − L. $\frac{121}{120}$,

L. $\frac{120}{80}$ = L. $\frac{3}{2}$,
L. $\frac{9}{4}$ = 2L. $\frac{3}{2}$,
L. $\frac{10}{4}$ = L. $\frac{10}{9}$ + L. $\frac{9}{4}$,
L. $\frac{10}{10}$ = 2L. $\frac{9}{4}$,

L. $\frac{80}{10}$ = L. $\frac{81}{10}$ − L. $\frac{81}{80}$
L. $\frac{8}{1}$ = L. $\frac{80}{10}$,
L. $\frac{8}{2}$ = L. $\frac{10}{4}$,
L. $\frac{2}{1}$ = L. $\frac{8}{2}$ − L. $\frac{8}{4}$.

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Having thus got the logarithm of the ratio of 2 to 1, or, in common language, the logarithm of 2, the logarithms of all ſorts of even numbers may be derived from thoſe of the odd numbers which are their coefficients with 2 or its powers. We may then proceed as follows.

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L. 4 = 2L. 2,	L. 100 = 2L. 10,	L. 2401 = L. $\frac{2401}{2400}$ + L. 2400,
L. 10 = L. $\frac{10}{4}$ + L. 4,	L. 8 = 3L. 2,	L. 7 = $\frac{1}{4}$ L. 2401,
L. 9 = L. $\frac{9}{4}$ + L. 4,	L. 24 = L. 8 + L. 3,	L. 11 = L. $\frac{11}{9}$ + L. 9.
L. 3 = $\frac{1}{2}$ L. 9.	L. 2400 = L. 100 + L. 24.	L. 6 = L. 2 + L. 3.

Thus we have got the logarithms of 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11. And this is upon the whole, perhaps, the beſt method of computing logarithms that can be taken.—This method of computing logarithms is very nearly the ſame with that of Sir Iſaac Newton in his ſecond letter to Mr Oldenburg, dated October 1676.

§ 7. *Conſtruction of Logarithms by Fluxions.*

From the definition and deſcription of logarithms given by Napier, and of which we have already taken notice, it appears that the fluxion of his, or the hyperbolic logarithm of any number, is a fourth proportional to that number, its logarithm and unity; or, which is the ſame, that it is equal to the fluxion of the number divided by the number: For the deſcription ſhows that $z1 : za$ or $1 :: \dot{z}1$ the fluxion of $z1 : za$, which therefore is $= \frac{\dot{z}1}{z1}$; but $\dot{z}a$ is alſo equal to the fluxion of the logarithm A, &c. by the deſcription; therefore the fluxion of the logarithm is equal to $\frac{\dot{z}1}{z1}$, the fluxion of the quantity divided by the quantity itſelf. The ſame thing appears again at art. 2. of of that little piece in the appendix to his *Conſtructio Logarithmorum*, intitled *Habitudines Logarithmorum & ſuorum naturalium numerorum invicem*; where he obſerves, that as any greater quantity is to a leſs, ſo is the velocity of the increment or decrement of the logarithms at the place of the leſs quantity to that at the greater. Now this velocity of the increment or decrement of the logarithms being the ſame thing as their fluxions, that proportion is this $x : a :: \text{flux. log. } a : \text{flux. log. } x$: hence if a be $= 1$, as at the beginning of the table of numbers, where the fluxion of the logs. is the index or characteriſtic c, which is alſo one in Napier's or the hyperbolic logarithms, and 43429, &c. in Briggs's, the ſame proportion becomes $x : 1 :: c : \text{flux. log. } x$; but the conſtant fluxion of the numbers is alſo 1, and therefore that proportion is alſo this $x : \dot{x} :: c : \frac{c\dot{x}}{x}$ = the fluxion of the logarithm of x: and in the hyperbolic logarithms, where c is $= 1$, it becomes $\frac{\dot{x}}{x}$ = the fluxion of Napier's or the hyperbolic logarithm of x. This ſame property has alſo been noticed by many other authors ſince Napier's time. And the ſame or a ſimilar property is evidently true in all the ſyſtems of logarithms whatever, namely, that the modulus of the ſyſtem is to any number as the fluxion of its logarithm is to the fluxion of the number.

Now from this property, by means of the doctrine of fluxions, are derived other ways for making logarithms, which have been illuſtrated by many writers on this branch; as Craig, Jo. Bernoulli, and almoſt all the writers on fluxions. And this method chiefly conſiſts in expanding the reciprocal of the given quantity in an infinite ſeries, then multiplying each term by the fluxion of the ſaid quantity, and laſtly taking the fluents of the terms; by which there ariſes an infinite ſeries of terms for the logarithm ſought. So, to find the logarithm of any number N, put any compound quantity for N, as ſuppoſe $\frac{n+x}{n}$; then the flux. of the log. or $\frac{\dot{N}}{N}$ being $\frac{\dot{x}}{n+x} = \frac{\dot{x}}{n} - \frac{x\dot{x}}{nn} + \frac{x^2\dot{x}}{n^3} - \frac{x^3\dot{x}}{n^4}$, &c. the fluents give log. of N or log. of $\frac{n+x}{n} = \frac{x}{n} - \frac{x^2}{2n^2} + \frac{x^3}{3n^3} - \frac{x^4}{4n^4}$, &c. And writing $-x$ for x gives log. $\frac{n-x}{n} = -\frac{x}{n} - \frac{x^2}{2n^2} - \frac{x^3}{3n^3} - \frac{x^4}{4n^4}$, &c. Alſo, becauſe $\frac{n}{n\pm x} = 1 \div \frac{n+x}{n}$, or log. $\frac{n}{n\pm x} = 0 -$ log. $\frac{n\pm x}{n}$, we have log. $\frac{n}{n+x} = -\frac{x}{n} + \frac{x^2}{2n^2} - \frac{x^3}{3n^3} + \frac{x^4}{4n^4}$, &c. and log. $\frac{n}{n-x} = +\frac{x}{n} + \frac{x^2}{2n^2} + \frac{x^3}{3n^3} + \frac{x^4}{4n^4}$, &c.

And by adding and ſubtracting any of theſe ſeries to or from one another, and multiplying or dividing their correſponding numbers, various other ſeries for logarithms may be found, converging much quicker than theſe do.

In like manner, by aſſuming quantities otherwiſe compounded for the value of N, various other forms of logarithmic ſeries may be found by the ſame means.

§ 8. *Mr Long's Method.*

This method was publiſhed in the 339th number of the Philoſophical Tranſactions; and is performed by means of a ſmall table containing eight claſſes of logarithms, as follows.

Conſtruction of Logarithms

Lo.	Nat. Numb.	Log.	Nat. Numb.	Log.	Nat. Numb.	Log.	Nat. Numb.
,9	7,943282347	,009	1,020939484	,00009	1,000207254	,0000009	1,000002072
,8	6,309573445	8	1,018591388	8	1,000184224	8	1,000001842
,7	5,011872336	7	1,016248694	7	1,000161194	7	1,000001611
,6	3,981071706	6	1,013911386	6	1,000138165	6	1,000001381
,5	3,162277660	5	1,011579454	5	1,000115136	5	1,000001151
,4	2,511886432	4	1,009252886	4	1,000092106	4	1,000000921
,3	1,995262315	3	1,006931669	3	1,000069080	3	1,000000690
,2	1,584893193	2	1,004615794	2	1,000046053	2	1,000000460
,1	1,258925412	1	1,002305238	1	1,000023026	1	1,000000230
,09	1,230268771	,0009	1,002074475	,000009	1,000020724	,0000009	1,000000207
8	1,202264435	8	1,001843766	8	1,000018421	8	1,000000184
7	1,174897555	7	1,001613109	7	1,000016118	7	1,000000161
6	1,148153621	6	1,001382506	6	1,000013816	6	1,000000138
5	1,122018454	5	1,001151956	5	1,000011513	5	1,000000115
4	1,096478196	4	1,000921459	4	1,000009210	4	1,000000092
3	1,071519305	3	1,000691015	3	1,000006908	3	1,000000069
2	1,047128548	2	1,000460623	2	1,000004605	2	1,000000046
1	1,023292992	1	1,000230285	1	1,000002302	1	1,000000023

Here, becauſe the logarithms in each claſs are the continual multiples 1, 2, 3, &c. of the loweſt, it is evident that the natural numbers are ſo many ſcales of geometrical proportionals, the loweſt being the common ratio, or the aſcending numbers are the 1, 2, 3, &c. powers of the loweſt, as expreſſed by the figures 1, 2, 3, &c. of their correſponding logarithms. Alſo the laſt number in the firſt, ſecond, third, &c. claſs, is the 10th, 100th, 1000th, &c. root of 10; and any number in any claſs is the 10th power of the correſponding number in the next following claſs.

To find the logarithm of any number, as ſuppoſe of 2000, by this table: Look in the firſt claſs for the number next leſs than the firſt figure 2, and it is 1,995262315, againſt which is 3 for the firſt figure of the logarithm ſought. Again, dividing 2, the number propoſed, by 1,995262315, the number found in the table, the quotient is 1,002374467; which being looked for in the ſecond claſs of the table, and finding neither its equal nor a leſs, 0 is therefore to be taken for the ſecond figure of the logarithm; and the ſame quotient 1,002374467 being looked for in the third claſs, the next leſs is there found to be 1,002305238, againſt which is 1 for the third figure of the logarithm; and dividing the quotient 1,002374467 by the ſaid next leſs number 1,002305238, the new quotient is 1,000069070; which being ſought in the fourth claſs gives 0, but ſought in the fifth claſs gives 2, which are the fourth and fifth figures of the logarithm ſought: again, dividing the laſt quotient by 1,000046053, the next leſs number in the table, the quotient is 1,000023015, which gives 9 in the 6th claſs for the 6th figure of the logarithm ſought: and again dividing the laſt quotient by 1,000020724, the next leſs number, the quotient is 1,000002291, the next leſs than which in the 7th claſs gives 9 for the 7th figure of the logarithm: and dividing the laſt quotient by 1,000002072, the quotient is 1,000000219, which gives 9 in the 8th claſs for the 8th figure of the logarithm: and again the laſt quotient 1,000000219 being divided by 1,000000207 the next leſs, the quotient 1,000000012 gives 5 in the ſame 8th claſs, when one figure is cut off, for the 9th figure of the logarithm ſought. All which figures collected together give 3,301029995 for Briggs's logarithm of 2000, the index 3 being ſupplied; which logarithm is true in the laſt figure.

To find the number anſwering to any given logarithm, as ſuppoſe to 3,3010300: omitting the characteriſtic, againſt the other figures 3, 0, 1, 0, 3, 0, 0, as in the firſt column in the margin, are the ſeveral numbers as in the ſecond column, found from their reſpective 1ſt, 2d, 3d, &c. claſſes; the effective numbers of which multiplied continually together, the laſt product is 2,000000019966, which, becauſe the characteriſtic is three, gives 2000,000019966 or 2000 only for the required number anſwering to the given logarithm.

3	1,995262315
0	
1	1,002305238
0	
3	1,000069080
0	
0	
0	

§ 9. *Mr Hutton's Practical Rule for the Conſtruction of Logarithms.*

The methods laid down in the above ſections are abundantly ſufficient to ſhow the various principles upon which logarithms may be conſtructed; though there are ſtill a variety of others which our limits will not admit of our inſerting: The following rule is added from Mr Hutton's Treatiſe on the ſubject, for the ſake of thoſe who do not chooſe to enter deeply into theſe inveſtigations.

Call z the ſum of any number whoſe logarithm is ſought, and the number next leſs by unity; divide ·86858896 38, &c. (or $2 \div 2.3025$, &c.) by z, and reſerve the quotient; divide the reſerved quotient by the ſquare of z, and reſerve this quotient; divide this laſt quotient alſo by the ſquare of z, and again reſerve this quotient; and thus proceed continually, dividing the laſt quotient by the ſquare of z as long as diviſion can be made. Then write theſe quotients orderly under one another, the firſt uppermoſt, and divide them reſpectively by the uneven numbers 1, 3, 5, 7, 9, 11, &c. as long as diviſion can be made; that is, divide the 1ſt reſerved quotient by 1, the 2d by 3, the 3d by 5, the 4th by 7, &c. Add all theſe laſt quotients together, and the ſum will be the logarithm of $b \div a$; and therefore to this logarithm add alſo the logarithm

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garithm of *a* the next leſs number, and the ſum will be the required logarithm of *b* the number propoſed.

Ex. 1. *To find the Log of* 2.—Here the next leſs number is 1, and $2+1=3=z$, whoſe ſquare is 9. Then,

3)	·868588964	1)	·289529654 (·289529654
9)	·289529654	3)	32169962 (10723321
9)	32169962	5)	3574440 (714888
9)	3574440	7)	397160 (56737
9)	397160	9)	44129 (4903
9)	44129	11)	4903 (446
9)	4903	13)	545 (42
9)	545	15)	61 (4
9)	61		

Log. $\frac{1}{1}$ - ·301029995
Add L. 1 - 000000000

Log. of 2 - ·301029995

Ex. 2. *To find the log. of* 3.—Here the next leſs number is 2, and $2+3=5=z$, whoſe ſquare is 25, to divide by which always multiply by ·04. Then

5)	·868588964	1)	·173717793 (·173717793
25)	·173717793	3)	6948712 (2316237
25)	6948712	5)	277948 (55590
25)	277948	7)	11118 (1588
25)	11118	9)	448 (50
25)	445	11)	18 (2
	18		

L. $\frac{1}{1}$ - - ·176091260
L. 2 add - ·301029995

L. 3 - - ·477121255

Then becauſe the ſum of the logarithms of numbers gives the logarithm of their product, and the difference of the logarithms gives the logarithm of the quotient of the numbers, from the above two logarithms, and the logarithm of 10, which is 1, we may raiſe a great many logarithms, thus:

Ex. 3. Becauſe $2\times2=4$, therefore
to L. 2 - - ·301029995 $\frac{2}{1}$
add L. 2 - - ·301029995 $\frac{2}{1}$
ſum is L. 4 - - ·602059991 $\frac{4}{1}$

Ex. 4. Becauſe $2\times3=6$, therefore
to L. 2 - - ·301029995
add L. 3 - - ·477121255
ſum is L. 6 - - ·778151250

Ex. 5. Becauſe $2^3=8$, therefore
L. 2. - - ·301029995 $\frac{3}{1}$
mult. by - - 3
gives L. 8 - - ·903089987

Ex. 6. Becauſe $3^2=9$, therefore
L. 3 - - ·477121254 $\frac{2}{1}$
mult. by - - 2
gives L. 9 - - ·954242509

Ex. 7. Becauſe $\frac{10}{2}=5$, therefore
from L. 10 - 1·000000000
take L. 2 - ·301029995 $\frac{5}{1}$
leaves L. 5 - ·698970004 $\frac{5}{1}$

Ex. 8 Becauſe $12=3\times4$, therefore
to L. 3 - - ·477121255
add L. 4 - ·602059991
gives L. 12 - - 1.079181246

And thus by computing, by the general rule, the logarithms of the other prime numbers 7, 11, 13, 17, 19, 23, &c.: and then uſing compoſition and diviſion, we may eaſily find as many logarithms as we pleaſe, or may ſpeedily examine any logarithm in the table.

§ 10. *Mr Thomas Atkinſon of Balliſhannon's Method.*

In any ſeries of numbers in a geometrical progreſſion, beginning from unity, as in the margin, the ſeries is compoſed of a ſet of continued proportionals, of which the member ſtanding neareſt to unity is the common ratio or rate of the proportion. If over or under theſe another ſeries is placed, as in the example, of numbers in an arithmetical progreſſion, beginning with nought, and whoſe common difference is unity, the members of this ſeries are called *indexes*; for they ſerve to ſhow how many ſucceſſive multiplications have been made with the common rate to produce that member of the geometrical progreſſion over which each of theſe indexes does ſeverally ſtand.

0	1	2	3
1	10	100	100

This theory may be conſidered in another light: If the ſquare root of 10 (that is, of the common rate) is found, it is a mean proportional between 1 and 10, and becomes a new common rate for a new ſet of continued proportionals, as in the margin. And if the half of unity, which in the former caſe was the additional difference of the arithmetical progreſſion, is made the additional difference of this new ſeries, and noted as in the example, a new combination is formed of two ſerieſes agreeing with the firſt in theſe remarkable properties, viz. If any two members of the geometrical progreſſion are multiplied together, the ſum of their correſponding indexes will become the index of their product; and converſely, if any of them is divided by any other, the difference of their indexes will be found to be the index of the quotient. This theory is indefinite; and repeated extractions may be made with any propoſed number of decimals, and biſection made of the correſponding indexes, until one has no more number to work with; and each of the mean proportionals thus found between 1 and 10, will be found a member of every new geometrical progreſſion formed by every ſmaller root; and conſequently all the roots thus found, together with their correſponding indexes, have, in caſes of multiplication or diviſion, the ſame connection as has been juſt deſcribed.

0	·5	1	1·5	2	25
1	3.16	10	31.6	100	316.

Let thoſe ſucceſſive roots be found, and noted in the form of a table, and, in another column, let the correſponding indexes found by theſe directions be regu-

Construction of Logarithms

larly noted, each oppoſite to its own roots. Theſe indexes are commonly known by the denomination of *logarithms*; the roots themſelves may be called *natural numbers*.

Theſe roots are compoſed of natural numbers ſeldom or never wanted; but from them the logarithms of ſuch as are of general uſe may be thus found.

Suppoſe 2 the propoſed number, one muſt examine the table of roots; there he will find 3.16, &c. &c. the neareſt to 2 of thoſe which are greater; and 1.778, &c. &c. alſo neareſt to it of thoſe which are leſs. He may make a diviſion at his pleaſure, either $\frac{3.16}{2}$ or $\frac{2}{1.77}$; yet let the choice fall on what will yield the ſmalleſt quotient, and let the circumſtances of the calculation be noted, as in the margin, for future direction. Here

$\frac{2}{1.77}$ = 1.1246, &c. &c.

$\frac{1.154}{1.124}$ = .02, &c. &c.

.0000087837, . . . 0000038147 its logm
.0000025175, its logm.

Thus knowing that 0.0000025175, or ſuch like, is the logm. of the laſt quotient, one may have that of 2, if he will but call to mind the following circumſtances.

In every caſe of diviſion, if he has logarithms of quotient and diviſor, he has alſo that of the dividend, by adding the two firſt together: if he has the logarithm of the dividend, and that of either the diviſor or quotient, he may find that of the other; for he has only to ſubtract what he knows from the logarithm of the dividend, the remainder is what he wants: and laſtly, that in every diviſion he made, he took one number from the table of roots whoſe logarithm is known, being noted in the table, and which he made uſe of as his direction either as a dividend or a diviſor: From theſe circumſtances, one may, by the help of the logarithm juſt found, diſcover the logarithm of that number of the laſt diviſion, whether it be dividend or diviſor, which was the quotient of the preceding diviſion; and thus, tracing his own work backwards by his notes from quotient to quotient, be they ever ſo few or ever ſo many, he will come at laſt by addition and ſubtraction to the logarithm of the propoſed number.

By this method, the logarithm of any number within the compaſs of the table of roots may be found: if a greater is propoſed, ſuppoſe 9495, it muſt be made 9.495, and its logarithm found; then it muſt be reſtored to the propoſed form, and have a proper index noted before the decimals juſt found. How to do this is too well known to have occaſion to mention it here.

Construction of Logarithms

$\frac{2}{1.77}$ = 1.1246. With this quotient let the table be applied to as before, and 1.1246, &c. will be found to be between 1.154, &c. &c. and 1.074, &c. &c. and diviſion to be made as in the example. In this manner one is to proceed with each ſucceſſive quotient, till at length he has one in which the number of the initial decimal noughts is equal at leaſt, if not greater than that of the ſignificant figures. Here the work of diviſion may be diſcontinued; and as it will rarely happen, that one will not have an additional initial nought for every diviſion, the number cannot be great in calculations of a moderate extent. Having at laſt found a quotient ſuch as was deſcribed, and ſuppoſing the number of decimals to be 10, one may readily find the logm. of that quotient thus:---Suppoſe the quotient 1.00000057968; he is to look into the table of roots for thoſe noted with 5 initial decimal noughts, and from any one of theſe and its correſponding logm. ſtate thus:

. . . . .00000057968 of the quotient.

The reaſon for finding the logarithm of the laſt quotient by the common proportion is this: He who has made a table of roots, will find, by inſpection only, that as initial noughts come into the decimal parts of the roots, the ſignificant figures juſt immediately following them do aſſume the form of a geometrical progreſſion, deſcending, whoſe common rate or diviſor is 2, as is juſt the caſe with the whole of the decimals of the correſponding logarithms; and that the number of the ſignificant figures endued with this property is generally equal to that of the initial noughts: ſo far as this, and no farther, the common proportion will hold between the ſignificant figures of the decimals in the roots and the ſame number of places in the logarithms; and for this reaſon it was needful to continue the ſucceſſive diviſions till a quotient was found ſo circumſtanced, that its logarithm could be found by the proportion.

The ſame gentleman hath alſo favoured us with the following new method

Of extracting Roots of Fractions by LOGARITHMS.

THE eaſieſt way to explain this, is firſt to give an example of involving ſuch numbers.

—3.301029995664 the logarithm of the fraction given.
7 the power to which it is to be raiſed.

—19.107209969648 the logarithm of the anſwer.

This differs from the like work in whole numbers only in this, that, in multiplying the decimals, one has at laſt 2 to be carried from them to the whole numbers; this is to be conſidered as + 2, then —3×7 = —21, and —21 + 2 = —19 to be noted the index of the anſwer. Extraction of the roots is only the converſe of this. Suppoſe —19.107209969648 given, to find that root whoſe exponent number is 7. As 7 is the exponent number here, one may in his mind multiply it by 2 for a trial, as in common diviſion; but the product = 14 being leſs than 19, muſt be rejected; then he may try it with 3, this yields 21 for a product. This 3 muſt be noted with a negative ſign for the index of the new logarithm. Then, on comparing 19 with 21, the difference is

—19.107209969648
—3.301029995664

2.

Explanation of the Table.

2. This 2 must be carried as 20 to the decimals, and one must from that carry on the division of the decimals with 7 for a divisor, as is usually done in other cases.

Explanation of the Table.

Another Example.

Suppose —1.4771212545 given, to extract the root of its 5th power.
—1.8954252109 the logarithm of the root.

For 5, the exponent of the root ×1 is greater than the index of the given logarithm, and 4 is the remainder. Then —1 becomes the index of the logarithm of the root; and 4= the overplus, is to be carried as 40to the decimals; and from that, division is to be made with 5 as a divisor for the rest of the work.

Sect. III. *Explanation and Use of the Table, with a general Account of the various Sciences to which Logarithms may be applied.*

§ 1. *To find by the table the Logarithm of any number.*

If the number be under 100, it is easily found in the first division at the head of the first page; if it be betwixt 100 and 1000, over against the number in the first column of the following pages, in the next column under 0 will be found the logarithm required. If the number be betwixt 1000 and 10000, the first three figures of the number are to be found in the column marked N° and the fourth figure at the top, and in the column under it, lineally against the first three figures, will be found the logarithm required, changing the index 2 into 3. The column marked Diff. and showing the common difference by which each of these columns increases, serves to find the logarithms of numbers beyond 10000. Thus,

To find the logarithm for a number greater than any in the common canon, but less than 10000000.—Cut off four figures on the left of the given number, and seek the logarithm in the table; add as many unites to the index as there are figures remaining on the right; subtract the logarithm found from the next following it in the table; then, as the difference of numbers in the canon is to the tabular distance of the logarithms answering to them, so are the remaining figures of the given number to the logarithmic difference; which, if it be added to the logarithm before found, the sum will be the logarithm required. Suppose v. gr. the logarithm of the number 92375 required. Cut off the four figures 9237, and to the characteristic of the logarithm corresponding to them, add an unit; then,

From the logarith. of the numb. 9238=3.965578
Subtract logarith. numb. ——9237=3.965531

Remains tabular difference 47
Then 10 : 47 :: 5 : 23
Now to the logarithm —— 4.965531
Add the difference found —— 23
The sum is the logarithm required.— 4.965554

Or more briefly; find the logarithm of the first four figures as before; then multiply the common difference which stands against it by the remaining figures of the given number; from the product, cut off as many figures at the right hand as you multiplied by, and add the remainder to the logarithm before found, fitting it with a proper index. Thus 47×5=235; cut off 5 and add 23.

To find the logarithm of a fraction.—Subtract the logarithm of the numerator from that of the denominator, and to the remainder prefix the sign of subtraction. Thus suppose it required to find the logarithm of the fraction $\frac{3}{7}$,

Logarithm of 7 = 0.845098
Logarithm of 3 = 0.477121

Logarithm of $\frac{3}{7}$ = —0.367977

The reason of the rule is, that a fraction being the quotient of the numerator divided by the denominator, its logarithm must be the difference of the logarithms of those two; so that the numerator being subtracted from the denominator, the difference becomes negative. Stifelius observed, that the logarithms of a proper fraction must always be negative, if that of unity be 0; which is evident, a fraction being less than one.

Or, the logarithm of the denominator, though greater than that of the numerator, as in the case of a proper fraction, may be subtracted from it, regard being had to the sign of the index, which alone in that case is negative. Thus,

Log. of 3 = 0.477121
Log. of 7 = 0.845098

Log. of $\frac{3}{7}$ = 1.632023 which produces the same effect in any operation as that before found, viz. —0.367977, this being to be subtracted, and the other to be added.

Or again, the fraction may be reduced to a decimal, and its logarithm found; which differs from that of a whole number only in the index, which is to be negative.

For an improper fraction v. gr. $\frac{9}{5}$, its numerator being greater than its denominator, its logarithm is had by subtracting the logarithm of the latter from that of the former.

The logarithm of 9=0.9542425
Logarithm of 5=0.6989700

Logarithm $\frac{9}{5}$=0.2552725

In the same manner may a logarithm of a mixt number, as $3\frac{2}{7}$, be found, it being first reduced into an improper fraction $\frac{23}{7}$.

Or, this improper fraction may be reduced to a mixed number, whose logarithm must be found as if it were wholly integral, and its index taken according to the integral part. We shall here observe, that the logarithms of whole numbers are added, subtracted, &c. according to the rules of these operations in decimal arithmetic; but with regard to the management of logarithms with negative indices, the same rules are to be observed as those given in algebra for like and unlike signs.

In addition, all the figures except the index, are reckoned positive, and therefore the figure to be carried to the index from the other part of the logarithm takes away so much from the negative index. Thus $1.8683326+\overline{3}.698972=\overline{1}.562298$. In subtraction, if either one or both of the logarithms have negative indices, you must change the sign of the index of the sub-

Explanation of the Table, &c.

subtrahend, after you have carried to it what may arise from the decimal part, and then add the indices: thus $\bar{1}.562298 - 1.863326 = 3.698972$. In multiplication, what is carried from the product of the other parts of the logarithms must be subtracted from the product of the indices: thus $\bar{2}.477121 \times 5 = \bar{8}.385605$. In division, if the divisor will exactly measure the index, proceed as in common arithmetic; *e. g.* $\bar{4}.924782 \div 2 = \bar{2}.462391$. But if the divisor will not exactly measure the index, add units to the index, till you can exactly divide it, and carry these units to the next number: *e. g.* $8.385605 \div 5 = \bar{2}.477121$.

To find the number corresponding to any given logarithm.—If the logarithm be within the limits of the table, *i. e.* if its index does not exceed 3, then neglecting the index, look down in the column of logarithms under 0, for the two or three first figures of your given logarithm; and if you exactly find all the figures of the given logarithm in that column, you have the number corresponding at the left hand: But if you do not find your logarithm exactly in the column under 0, you must run through the other columns till you find it exactly, or till you obtain the next least logarithm; and in the column of numbers lineally against it, you have the first 3 figures of the number sought, to which join the figure over the column, where your logarithm or its next least was found, and you have the corresponding number, *e. gr.* the number answering to the logarithm 3.544812 is 3506.

If the index of this logarithm had been 1, then the two last figures of the number would have been decimal; with the index 0, its corresponding number would have been 3.506; with $\bar{1}$, .3506; with $\bar{2}$, .03506, &c.

If the logarithm cannot be found exactly, take the next least, and make the difference between the given logarithm and the next least the numerator of a fraction whose denominator shall be the common difference, and add the fraction to the number found in the table.

To find the number corresponding to a logarithm greater than any in the table.—First, from the given logarithm, subtract the logarithm of 10, or 100, or 1000, or 10,000, till you have a logarithm that will come within the compass of the table; find the number corresponding to this, and multiply it by 10, or 100, or 1000, or 10,000, the product is the number required.

Suppose, for instance, the number corresponding to the logarithm 7.7589982 be required: subtract the logarithm of the number 10,000, which is 4.0000000, from 7.589982; the remainder is 3.7589982, the number corresponding to which is $5741\frac{1}{100}$: this multiplied by 10,000, the product is 57411100, the number required,

Otherwise seek the decimal member of the logarithm in the table, and if you can find it exactly, you have the four first figures of the number in the table, to which affix as many ciphers as the given index exceeds 3, and it is the number required. But if you cannot find the logarithm exactly, take the next least, and find the four first figures of the corresponding number; then take the difference betwixt the given logarithm and the next least, and annex to it as many ciphers as the index exceeds 3; then divide by the common difference, and affix the quotient to the four first figures, and you have the number required.

Explanation of the Table, &c.

To find the number corresponding to a negative logarithm. To the given negative logarithm add the last logarithm of the table, or that of the number 10000; *i. e.* subtract the first from the second, and find the number corresponding to the remainder; this will be the numerator of the fraction, whose denominator will be 10000; *v. gr.* suppose it to be required to find the fraction corresponding to the negative logarithm

0.3679767, subtract this from
4.0000000

The remainder is —— 3.6320233, the number corresponding to which is $4285\frac{71}{100}$, the fraction sought therefore is $\frac{4285}{10000}$. The reason of the rule is, that as a fraction is the quotient, arising on the division of the numerator by the denominator, unity will be to the fraction as the denominator to the numerator; but as unity is to the fraction corresponding to the given negative logarithm, so is 10000 to the number corresponding to the remainder: therefore, if 10000 be taken for the denominator, the number will be the numerator of the fraction required.

The negative logarithm —0.367977 is equal to the logarithm $\bar{1}.632023$, and the number answering to it, found in the manner already directed, will be $.4285\frac{71}{100}$.

The sines, tangents, &c. of any arch are easily found by seeking the degree at the top, if the arch be less than 45°, and the minutes at the side, beginning from the top, and by seeking the degree, &c. at the bottom, if the arch is greater than 45°. If a given logarithmic sine or tangent falls between those in the tables, then the corresponding degrees and minutes may be reckoned $\frac{1}{4}$, $\frac{1}{3}$, or $\frac{1}{2}$, &c. minutes more than those belonging to the nearest less logarithm in the tables, according as its difference from the given one is $\frac{1}{4}$, or $\frac{1}{3}$, or $\frac{1}{2}$, &c, of the difference between the logarithm next greater and next less than the given log.

§ 2. *Of the various Sciences to which Logarithms may be applied.*

As these artificial numbers constitute a new species of arithmetic capable of performing every thing which can be done in the old way, it is plain that its use must be equally extensive, and that in every science in which common arithmetic can be useful, the logarithmical arithmetic must be much more so, by reason of its being more easily performed. Though the general principles of logarithmical arithmetic have been already laid down, we shall here, in order to render the subject still more plain, subjoin the following practical rules.

I. *Multiplication by Logarithms.*

Add together the logarithms of all the factors, and the sum is a logarithm, the natural number corresponding to which will be the product required.

Observing to add, to the sum of the affirmative indices, what is carried from the sum of the decimal parts of the logarithms.

And that the difference betwixt the affirmative and negative indices is to be taken for the index to the logarithm of the product.

Division by Logarithms

Ex. 1. To multiply 23·14 by 5·062.

23.14 its log. is 1·3643634
5·062 its log. is 0·7043221

Product 117·1347 - 2·0686855

Ex. 2. To mult. 2·581926 by 3·457291.

2.581926 its log. is 0·4119438
3·457291 - - 0.5387359

Prod. 8.92647 - 0.9506797

Ex. 3. To mult. 3·902, and 597·16, and ·0314728 all together.

3·902 its log. is 0·5912873
597·16 - - $\bar{2}$·7760907
·0314728 - $\bar{2}$·4979353

Prod. 73·33533 - 1·8653133

The $\bar{2}$ cancels the 2, and the 1 to carry from the decimals is set down.

Ex. 4. To mult. 35·86, and 2·1046, and 0·8372, and 0·0294 all together.

3·586 its log. is 0·5546103
2·1046 - - 0·3231696
0·8372 - - $\bar{1}$·9228292
0·0294 - - $\bar{2}$·4683473

Prod. ·1857618 - - $\bar{1}$·2689564

Here the 2 to carry cancels the $\bar{2}$, and there remain the $\bar{1}$ to set down.

II. *Division by Logarithms.*

From the logarithm of the dividend subtract the logarithm of the divisor, the remainder is a logarithm whose corresponding number will be the quotient required.

But first observe to change the sign of the index of the logarithm of the divisor, viz. from negative to affirmative, or from affirmative to negative; then take the sum of the indices if they be of the same kind, or their difference when of different signs, with the sign of the greater, for the index to the logarithm of the quotient.

And when 1 is borrowed in the left-hand place of the decimal part of the logarithm, add it to the index of the logarithm of the divisor when that index is affirmative, but subtract it when negative; then let the index thus found be changed, and worked with as before.

Ex. 1. To divide 24163 by 4567.

Divide 24163 its log. 4·3831509
Divis. 4567 - - 3·6596310

Quot. 5·290782 - 0·7235199

Ex. 2. To divide 37·149 by 523·76.

Divid. 37·149 its log. 1·5699471
Divis. 523.76 - - 2·7191323

Quot. ·07092752 - $\bar{2}$·8508148

Ex. 3. To divide ·06314 by ·007241.

Divid. ·06314 its log· $\bar{2}$·8003046
Divis. ·007241 - - $\bar{3}$·8597985

Quot. 8·719792 - 0·9405061

Here $\bar{1}$ carried from the decimals to the 3 makes it become $\bar{2}$, which taken from the other $\bar{2}$, leaves 0 remaining.

Rule of Three by Logarithms

Ex. 4. To divide ·7438 by 12·9476.

Divid. ·7438 its log. 1·8714562
Divis. 12·9476 - 1.1121893

Quot. ·05744694 - $\bar{2}$·7592669

Here the 1 taken from the $\bar{1}$ makes it become $\bar{2}$ to set down.

III. *The Rule of Three, or Proportion.*

Add the logarithms of the 2d and 3d terms together, and from their sum subtract the logarithm of the 1st by the foregoing rules; the remainder will be the logarithm of the 4th term required.

Or in any compound proportion whatever, add together the logarithms of all the terms that are to be multiplied, and from that sum take the sum of the others; the remainder will be the logarithm of the term sought.

But instead of subtracting any logarithm, we may add its complement, and the result will be the same. By the complement is meant the logarithm of the reciprocal of the given number, or the remainder by taking the given logarithm from 0, or from 10, changing the radix from 0 to 10; the easiest method of doing which, is to begin at the left hand, and subtract each figure from 9, except the last significant figure on the right-hand, which must be subtracted from 10. But when the index is negative, add it to 9, and subtract the rest as before. And for every complement that is added, subtract 10 from the last sum of the indices.

Ex. 1. To find a 4th proportional to 72·34, and 2·519, and 357.4862.

As 72·34 - comp. log. 8·1406215
To 2·519 - - 0·4012282
So 357·4862 - - 2·5532592

To 12·44827 - - 1·0951089

Ex. 2. To find a 3d proportional to 12·796 and 3·24718.

As 12·796 - - comp. log. 8·8929258
To 3·24718 - - 0·5115064
So 3·24718 - - 0·5115064

To ·8240216 - - $\bar{1}$·9159386

Ex. 3. To find a number in proportion to ·379145 as ·85132 is to ·0649.

As ·0649 - comp. log. 11·1877553
To ·85132 - - $\bar{1}$.9300928
So ·379145 - - - $\bar{1}$.5788054

To 4·973401 - - 0·6966535

Ex. 4. If the interest of 100 l. for a year or 365 days be 4·5 l. what will be the interest of 279·25 l. for 274 days?

As $\begin{cases}100\\365\end{cases}$ comp. log. $\begin{cases}8\cdot0000000\\7\cdot4377071\end{cases}$
To $\begin{cases}279\cdot25 - -\\274 - -\end{cases}$ $\begin{cases}2\cdot4459932\\2\cdot4377506\end{cases}$
So 4·5 - - - 0·6532125

To 9·433296 - - 0·9746634

IV.

Involution by Logarithms.

IV. *Involution, or raising of Powers.*

Multiply the logarithm of the number given by the propoſed index of the power, and the product will be the logarithm of the power ſought.

Note. In multiplying a logarithm with a negative index by any affirmative number, the product will be negative.---But what is to be carried from the decimal part of the logarithm will be affirmative.---Therefore the difference will be the index of the product; and is to be accounted of the ſame kind with the greater.

Ex. 1. To find the 2d power of 2·5791.

Root 2·5791 its log.	-	0·4114682
index	- -	2
Power 6·651756	- -	0·8229364

Ex. 2. To find the cube of 3.07146.

Root 3·07146 its log.	-	0·4873449
index	- - -	3
Power 28·97575	- -	1·4620347

Ex. 3. To find the 4th power of ·09163.

Root ·09163 its log.	-	$\bar{2}$.9620377
index	- -	4
Power ·0000704938	-	$\bar{5}$·8481508

Here 4 times the negative index being $\bar{8}$, and 3 to carry, the difference $\bar{5}$ is the index of the product.

Ex. 4. To find the 365th power of 1·0045.

Root 1·0045 its log	-	0·0019499
index	- -	365
		97495
		116994
		58497
Power 5·148888	- -	0.7117135

V. *Evolution, or Extraction of Roots.*

Divide the logarithm of the power or given number by its index, and the quotient will be the logarithm of the root required.

Note. When the index of the logarithm is negative, and the diviſor is not exactly contained in it without a remainder, increaſe it by ſuch a number as will make it exactly diviſible; and carry the units borrowed, as ſo many tens, to the left-hand place of the decimal part of the logarithm; then divide the reſults by the index of the root.

Evolution by Logarithms.

Ex. 1. To find the ſquare root of 365.

Power 365	- -	2)2·5622929
Root 19·10498	- -	1·2811465

Ex. 2. To find the cube root of 12345.

Power 12345	- -	3)4·0914911
Root 23·11162	- -	1·3638304

Ex. 3. To find the 10th root of 2.

Power 2	- -	10)0·3010300
Root 1·071773	- -	0·0301630

Ex. 4. To find the 365th root of 1·045.

Power 1·045	- -	365)0.0191163
Root 1·000121	- -	0·0000524

Ex. 5. To find the ſquare root of ·093.

Power ·093	-	2)$\bar{2}$·9684829
Root ·304959	- -	1·4842415

Here the diviſor 2 is contained exactly once in $\bar{2}$ the negative index; therefore the index of the quotient is $\bar{1}$.

Ex. 6. To find the cube root of ·00048.

Power	- - -	3)$\bar{4}$·6812412
Root ·07829735	-	$\bar{2}$·8937471

Here the diviſor 3 not being exactly contained in $\bar{4}$, augment it by 2, to make it become $\bar{6}$, in which the diviſor is contained juſt $\bar{2}$ times; and the 2 borrowed being carried to the other figures 6, &c. makes 2·6812412, which divided by 3 gives ·8937471.

In trigonometry, the uſe of logarithmical ſines, tangents, &c. are uſed as well as the common arithmetical logarithms; and by uſing them according to the rules above laid down, the operations are ſhortened to a degree altogether incredible to perſons unacquainted with this invention. With equal facility are the problems in aſtronomy and navigation ſolved by their means, as well as thoſe of the higher geometry, fluxions, and in ſhort every thing which requires deep and laborious calculation. For the particular application of them to the different ſciences, ſee the articles NAVIGATION, TRIGONOMETRY, &c.

A TABLE of LOGARITHMS from 1 to 10,000.

N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.
1	0.000000	12	1.079181	23	1.361728	34	1.531479	45	1.653212	56	1.748188	67	1.826075	78	1.892095	89	1.949390
2	0.301030	13	1.113943	24	1.380211	35	1.544068	46	1.662758	57	1.755875	68	1.832508	79	1.897627	90	1.954242
3	0.477121	14	1.146128	25	1.397940	36	1.556302	47	1.672098	58	1.763428	69	1.838849	80	1.903090	91	1.959041
4	0.602060	15	1.176091	26	1.414973	37	1.568202	48	1.681241	59	1.770852	70	1.845098	81	1.908485	92	1.963788
5	0.698970	16	1.204120	27	1.431364	38	1.579784	49	1.690196	60	1.778151	71	1.851258	82	1.913814	93	1.968483
6	0.778151	17	1.230449	28	1.447158	39	1.591065	50	1.698970	61	1.785330	72	1.857332	83	1.919078	94	1.973128
7	0.845098	18	1.255272	29	1.462398	40	1.602060	51	1.707570	62	1.792392	73	1.863323	84	1.924279	95	1.977724
8	0.903090	19	1.278754	30	1.477121	41	1.612784	52	1.716003	63	1.799340	74	1.869232	85	1.929419	96	1.982271
9	0.954242	20	1.301030	31	1.491362	42	1.623249	53	1.724276	64	1.806180	75	1.875061	86	1.934498	97	1.986772
10	1.000000	21	1.322219	32	1.505150	43	1.633468	54	1.732394	65	1.812913	76	1.880814	87	1.939519	98	1.991226
11	1.041393	22	1.342423	33	1.518514	44	1.643453	55	1.740363	66	1.819544	77	1.886491	88	1.944483	99	1.995635

N°	0	1	2	3	4	5	6	7	8	9	Diff.
100	2.000000	2.000434	2.000868	2.001301	2.001734	2.002166	2.002598	2.003029	2.003460	2.003891	432
101	2.004321	2.004751	2.005180	2.005609	2.006038	2.006466	2.006894	2.007321	2.007748	2.008174	428
102	2.008600	2.009026	2.009451	2.009876	2.010300	2.010724	2.011147	2.011570	2.011993	2.012415	424
103	2.012837	2.013259	2.013680	2.014100	2.014520	2.014940	2.015360	2.015779	2.016197	2.016615	419
104	2.017033	2.017451	2.017868	2.018284	2.018700	2.019116	2.019532	2.019947	2.020361	2.020775	416
105	2.021189	2.021603	2.022016	2.022438	2.022841	2.023252	2.023664	2.024075	2.024486	2.024896	412
106	2.025306	2.025715	2.026124	2.026533	2.026942	2.027350	2.027757	2.028164	2.028571	2.028978	408
107	2.029384	2.029789	2.030195	2.030600	2.031004	2.031408	2.031812	2.032216	2.032619	2.033021	404
108	2.033424	2.033826	2.034227	2.034628	2.035029	2.035430	2.035830	2.036229	2.036629	2.037028	400
109	2.037426	2.037825	2.038223	2.038620	2.039017	2.039414	2.039811	2.040207	2.040602	2.040998	396
110	2.041393	2.041787	2.042182	2.042575	2.042969	2.043362	2.043755	2.044148	2.044540	2.044931	393
111	2.045323	2.045714	2.046105	2.046495	2.046885	2.047275	2.047664	2.048053	2.048442	2.048830	389
112	2.049218	2.049606	2.049993	2.050380	2.050766	2.051152	2.051538	2.051924	2.052309	2.052694	386
113	2.053078	2.053463	2.053846	2.054230	2.054613	2.054996	2.055378	2.055760	2.056142	2.056524	382
114	2.056905	2.057286	2.057666	2.058046	2.058426	2.058805	2.059185	2.059563	2.059942	2.060320	379
115	2.060698	2.061075	2.061452	2.061829	2.062206	2.062582	2.062958	2.063333	2.063709	2.064083	376
116	2.064458	2.064832	2.065206	2.065580	2.065953	2.066326	2.066698	2.067071	2.067443	2.067814	372
117	2.068186	2.068557	2.068928	2.069298	2.069668	2.070038	2.070407	2.070766	2.071145	2.071514	369
118	2.071882	2.072250	2.072617	2.072985	2.073352	2.073718	2.074085	2.074451	2.074816	2.075182	366
119	2.075547	2.075912	2.076276	2.076640	2.077004	2.077368	2.077731	2.078094	2.078457	2.078819	363
120	2.079181	2.079543	2.079904	2.080266	2.080626	2.080987	2.081347	2.081707	2.082067	2.082426	360
121	2.082785	2.083144	2.083505	2.083861	2.084219	2.084576	2.084934	2.085291	2.085647	2.086001	357
122	2.086360	2.086716	2.087071	2.087426	2.087781	2.088136	2.088490	2.088845	2.089198	2.089552	355
123	2.089905	2.090258	2.090611	2.090963	2.091315	2.091667	2.092018	2.092370	2.092721	2.093071	351
124	2.093422	2.093772	2.094122	2.094471	2.094820	2.095169	2.095518	2.095866	2.096215	2.096562	349
125	2.096910	2.097257	2.097604	2.097951	2.098297	2.098644	2.098990	2.099335	2.099681	2.100026	346
126	2.100371	2.100715	2.101059	2.101403	2.101747	2.102090	2.102434	2.102777	2.103119	2.103462	343
127	2.103804	2.104145	2.104487	2.104828	2.105169	2.105510	2.105851	1.106191	2.106531	2.106870	340
128	2.107210	2.107549	2.107888	2.108227	2.108565	2.108903	2.109241	2.109578	2.109916	2.110253	338
129	2.110590	2.110926	2.111262	2.111598	2.111934	2.112270	2.112605	2.112940	2.113275	2.113609	335
130	2.113943	2.114277	2.114611	2.114944	2.115278	2.115610	2.115943	2.116276	2.116608	2.116940	333
131	2.117271	2.117603	2.117934	2.118265	2.118595	2.118926	2.119256	2.119586	2.119915	2.120245	330
132	2.120574	2.120903	2.121231	2.121560	2.121888	2.122216	2.122543	2.122871	2.123198	2.123525	328
133	2.123852	2.124178	2.124504	2.124830	2.125156	2.125481	2.125806	2.126131	2.126456	2.126781	325
134	2.127105	2.127429	2.127752	2.128076	2.128399	2.128722	2.129045	2.129368	2.129690	2.130012	323
135	2.130334	2.130655	2.130977	2.131298	2.131619	2.131939	2.132260	2.132580	2.132900	2.133219	321
136	2.133539	2.133858	2.134177	2.134496	2.134814	2.135133	2.135451	2.135768	2.136086	2.136403	318
137	2.136721	2.137037	2.137354	2.137670	2.137987	2.138303	2.138618	2.138934	2.139249	2.139564	315
138	2.139879	2.140194	2.140508	2.140822	2.141136	2.141450	2.141763	2.142076	2.142389	2.142702	314
139	2.143015	2.143327	2.143639	2.143951	2.144263	2.144574	2.144885	2.145196	2.145507	2.145818	311

N°	0.	1.	2.	3	4	5	6	7	8	9	Diff.
140	2.146128	2.146438	2.146748	2.147058	2.147367	2.147676	2.147985	2.148294	2.148603	2.148911	309
141	2.149219	2.149527	2.149835	2.150142	2.150449	2.150756	2.151063	2.151370	2.151676	2.151982	307
142	2.152288	2.152594	2.152900	2.153205	2.153510	2.153815	2.154119	2.154424	2.154728	2.155032	305
143	2.155336	2.155640	2.155943	2.156246	2.156549	2.156852	2.157154	2.157457	2.157759	2.158061	303
144	2.158362	2.158664	2.158965	2.159266	2.159567	2.159868	2.160168	2.160468	2.160769	2.161068	301
145	2.161368	2.161667	2.161967	2.162266	2.162564	2.162863	2.163161	2.163459	2.163757	2.164055	299
146	2.164353	2.164650	2.164947	2.165244	2.165541	2.165838	2.166134	2.166430	2.166726	2.167022	297
147	2.167317	2.167613	2.167908	2.168203	2.168497	2.168792	2.169086	2.169380	2.169674	2.169968	295
148	2.170262	2.170555	2.170848	2.171141	2.171434	2.171726	2.172019	2.172311	2.172603	2.172895	293
149	2.173186	2.173478	2.173769	2.174060	2.174351	2.174641	2.174932	2.175222	2.175512	2.175802	291
150	2.176091	2.176381	2.176670	2.176959	2.177248	2.177536	2.177825	2.178113	2.178401	2.178689	289
151	2.178977	2.179264	2.179552	2.179839	2.180126	2.180413	2.180699	2.180986	2.181272	2.181558	287
152	2.181844	2.182129	2.182415	2.182700	2.182985	2.183270	2.183554	2.183839	2.184123	2.184407	285
153	2.184691	2.184975	2.185259	2.185542	2.185826	2.186108	2.186391	2.186674	2.186956	2.187239	283
154	2.187521	2.187803	2.188084	2.188366	2.188647	2.188928	2.189209	2.189490	2.189771	2.190051	281
155	2.190332	2.190612	2.190892	2.191171	2.191451	2.191730	2.192010	2.192289	2.192567	2.192846	279
156	2.193125	2.193403	2.193681	2.193959	2.194237	2.194514	2.194792	2.195069	2.195346	2.195623	278
157	2.195900	2.196176	2.196452	2.196729	2.197005	2.197280	2.197556	2.197832	2.198107	2.198382	276
158	2.198657	2.198932	2.199206	2.199481	2.199755	2.200029	2.200303	2.200577	2.200850	2.201124	274
159	2.201397	2.201670	2.201943	2.202216	2.202488	2.202761	2.203033	2.203305	2.203577	2.203848	272
160	2.204120	2.204391	2.204662	2.204933	2.205204	2.205475	2.205745	2.206016	2.206286	2.206556	271
161	2.206826	2.207095	2.207365	2.207634	2.207903	2.208172	2.208441	2.208710	2.208978	2.209247	269
162	2.209515	2.209783	2.210051	2.210318	2.210586	2.210853	2.211120	2.211388	2.211654	2.211921	267
163	2.212188	2.212454	2.212720	2.212986	2.213252	2.213518	2.213783	2.214049	2.214314	2.214579	266
164	2.214844	2.215109	2.215373	2.215638	2.215902	2.216166	2.216430	2.216694	2.216957	2.217221	264
165	2.217484	2.217747	2.218010	2.218273	2.218535	2.218798	2.219060	2.219322	2.219584	2.219846	262
166	2.220108	2.220370	2.220631	2.220892	2.221153	2.221414	2.221675	2.221936	2.222196	2.222456	261
167	2.222716	2.222976	2.223236	2.223496	2.223755	2.224015	2.224274	2.224533	2.224792	2.225051	259
168	2.225309	2.225568	2.225826	2.226084	2.226342	2.226600	2.226858	2.227115	2.227372	2.227630	258
169	2.227887	2.228143	2.228400	2.228657	2.228913	2.229170	2.229426	2.229682	2.229938	2.230193	256
170	2.230449	2.230704	2.230960	2.231215	2.231470	2.231724	2.231979	2.232233	2.232488	2.232742	254
171	2.232996	2.233250	2.233504	2.233757	2.234011	2.234264	2.234517	2.234770	2.235023	2.235276	253
172	2.235528	2.235781	2.236033	2.236285	2.236537	2.236789	2.237041	2.237292	2.237544	2.237795	252
173	2.238046	2.238297	2.238548	2.238799	2.239049	2.239299	2.239549	2.239800	2.240050	2.240299	250
174	2.240549	2.240799	2.241048	2.241297	2.241546	2.241795	2.242044	2.242293	2.242541	2.242790	249
175	2.243038	2.243286	2.243534	2.243782	2.244030	2.244277	2.244524	2.244772	2.245010	2.245266	248
176	2.245513	2.245759	2.246006	2.246252	2.246499	2.246745	2.246991	2.247236	2.247482	2.247728	246
177	2.247973	2.248219	2.248464	2.248709	2.248954	2.249198	2.249443	2.249687	2.249932	2.250176	245
178	2.250420	2.250664	2.250908	2.251151	2.251395	2.251638	2.251881	2.252125	2.252367	2.252610	243
179	2.252853	2.253096	2.253338	2.253580	2.253822	2.254064	2.254306	2.254548	2.254790	2.255031	242
180	2.255272	2.255514	2.255755	2.255996	2.256236	2.256477	2.256718	2.256958	2.257189	2.257439	241
181	2.257679	2.257918	2.258158	2.258398	2.258637	2.258877	2.259116	2.259355	2.259594	2.259833	239
182	2.260071	2.260310	2.260548	2.260787	2.261025	2.261263	2.261501	2.261738	2.261976	2.262214	238
183	2.262451	2.262688	2.262925	2.263162	2.263399	2.263636	2.263873	2.264109	2.264345	2.264582	237
184	2.264818	2.265054	2.265290	2.265525	2.265761	2.265996	2.266232	2.266467	2.266702	2.266937	235
185	2.267172	2.267406	2.267641	2.267875	2.268110	2.268344	2.268578	2.268812	2.269046	2.269279	234
186	2.269513	2.269746	2.269980	2.270213	2.270446	2.270679	2.270912	2.271144	2.271377	2.271609	233
187	2.271842	2.272074	2.272306	2.272538	2.272770	2.273001	2.273233	2.273464	2.273696	2.273927	232
188	2.274158	2.274389	2.274620	2.274850	2.275081	2.275311	2.275542	2.275772	2.276002	2.276232	230
189	2.276462	2.276691	2.276921	2.277151	2.277380	2.277609	2.277838	2.278067	2.278296	2.278525	229
190	2.278574	2.278982	2.279210	2.279439	2.279667	2.279895	2.280123	2.280351	2.280578	2.280806	228
191	2.281033	2.281261	2.281488	2.281715	2.281942	2.282169	2.282395	2.282622	2.282849	2.283075	227
192	2.283301	2.283527	2.283753	2.283979	2.284205	2.284431	2.284656	2.284882	2.285107	2.285332	226
193	2.285557	2.285782	2.286007	2.286232	2.286456	2.286681	2.286905	2.287130	2.287354	2.287578	225
194	2.287802	2.288025	2.288249	2.288473	2.288696	2.288920	2.289143	2.289366	2.289589	2.289812	223

N°	0	1	2	3	4	5	6	7	8	9	Diff.
195	2.290035	2.290257	2.290480	2.290702	2.290925	2.291147	2.291369	2.291591	2.291813	2.292034	222
196	2.292256	2.292478	2.292699	2.292920	2.293141	2.293362	2.293583	2.293804	2.294025	2.294246	221
197	2.294466	2.294687	2.294907	2.295127	2.295347	2.295567	2.295787	2.296007	2.296226	2.296446	220
198	2.296665	2.296884	2.297104	2.297323	2.297542	2.297760	2.297979	2.298198	2.298416	2.298635	219
199	2.298853	2.299071	2.299289	2.299507	2.299725	2.299943	2.300160	2.300378	2.300595	2.300813	218
200	2.301030	2.301247	2.301464	2.301681	2.301898	2.302114	2.302331	2.302547	2.302764	2.302980	217
201	2.303196	2.303412	2.303628	2.303844	2.304059	2.304275	2.304490	2.304706	2.304921	2.305136	216
202	2.305351	2.305566	2.305781	2.305996	2.306210	2.306425	2.306639	2.306854	2.307068	2.307282	215
203	2.307496	2.307710	2.307924	2.308137	2.308351	2.308564	2.308778	2.308991	2.309204	2.309417	213
204	2.309630	2.309843	2.310056	2.310268	2.310481	2.310693	2.310906	2.311118	2.311330	2.311542	212
205	2.311754	2.311966	2.312177	2.312389	2.312600	2.312812	2.313023	2.313324	2.313445	2.313656	211
206	2.313867	2.314078	2.314289	2.314499	2.314710	2.314920	2.315130	2.315340	2.315550	2.315760	210
207	2.315970	2.316180	2.316390	2.316599	2.316809	2.317018	2.317227	2.317436	2.317645	2.317854	209
208	2.318063	2.318272	2.318481	2.318689	2.318898	2.319106	2.319314	2.319523	2.319730	2.319938	208
209	2.320146	2.320354	2.320562	2.320769	2.320977	2.321184	2.321391	2.321598	2.321805	2.322012	207
210	2.322219	2.322426	2.322633	2.322839	2.323046	2.323252	2.323458	2.323664	2.323871	2.324077	206
211	2.324282	2.324488	2.324694	2.324899	2.325105	2.325310	2.325516	2.325721	2.325926	2.326131	205
212	2.326336	2.326541	2.326745	2.326950	2.327154	2.327359	2.327563	2.327767	2.327972	2.328176	204
213	2.328380	2.328583	2.328787	2.328991	2.329194	2.329398	2.329601	2.329804	2.330008	2.330211	203
214	2.330414	2.330617	2.330819	2.331022	2.331225	2.331427	2.331629	2.331832	2.332034	2.332236	202
215	2.332438	2.332640	2.332842	2.333044	2.333264	2.333447	2.333649	2.333850	2.334051	2.334253	202
216	2.334454	2.334655	2.334856	2.335056	2.335257	2.335458	2.335658	2.335859	2.336059	2.336259	201
217	2.336460	2.336660	2.336860	2.337060	2.337260	2.337459	2.337659	2.337858	2.338058	2.338257	200
218	2.338456	2.338656	2.338855	2.339054	2.339253	2.339451	2.339650	2.339849	2.340047	2.340246	199
219	2.340444	2.340642	2.340840	2.341039	2.341235	2.341434	2.341632	2.341830	2.342028	2.342225	198
220	2.342423	2.342620	2.342817	2.343014	2.343212	2.343409	2.343605	2.343802	2.343999	2.344196	197
221	2.344392	2.344589	2.344785	2.344981	2.345178	2.345374	2.345570	2.345766	2.345961	2.346157	196
222	2.346353	2.346540	2.346744	2.346939	2.347135	2.347330	2.347525	2.347720	2.347915	2.348110	195
223	2.348305	2.348500	2.348694	2.348889	2.349083	2.349277	2.349472	2.349660	2.349860	2.350054	194
224	2.350248	2.350442	2.350636	2.350829	2.351023	2.351216	2.351500	2.351603	2.351796	2.351989	193
225	2.352182	2.352375	2.352568	2.352761	2.352954	2.353146	2.353339	2.353532	2.353724	2.353916	193
226	2.354108	2.354301	2.354493	2.354684	2.354876	2.355068	2.355260	2.355451	2.355643	2.355834	192
227	2.356026	2.356217	2.356408	2.356599	2.356790	2.356981	2.357172	2.357363	2.357554	3.357744	191
228	2.357935	2.358125	2.358316	2.358506	2.358696	2.358886	2.359076	2.359266	2.359456	2.359646	190
229	2.359835	2.360025	2.360215	2.360404	2.360593	2.360783	2.360972	2.361161	2.361350	2.361539	189
230	2.361728	2.361917	2.362105	2.362294	2.362482	2.362671	2.362859	2.363048	2.363236	2.363424	188
231	2.363612	2.363800	2.363988	2.364176	2.364363	2.364551	2.364739	2.364926	2.365113	2.365301	188
232	2.365488	2.365675	2.365862	2.366049	2.366236	2.366423	2.366700	2.366796	2.366983	2.367169	187
233	2.367356	2.367542	2.367728	2.367915	2.368101	2.368287	2.368473	2.368659	2.368844	2.369030	186
234	2.369216	2.369401	2.369587	2.369772	2.369958	2.370143	2.370328	2.370513	2.370698	2.370883	185
235	2.371068	2.371253	2.371437	2.371622	2.371806	2.371991	2.372175	2.372360	2.372544	2.372728	184
236	2.372912	2.373096	2.373280	2.373464	2.373647	2.373831	2.374015	2.374198	2.374382	2.374565	184
237	2.374748	2.374931	2.375115	2.375298	2.375481	2.375664	2.375846	2.376029	2.376212	2.376394	183
238	2.376577	2.376759	2.376942	2.377124	2.377306	2.377488	2.377670	2.377852	2.378034	2.378216	182
239	2.378398	2.378580	2.378761	2.378943	2.379124	2.379305	2.379487	2.379668	2.379849	2.380030	181
240	2.380211	2.380392	2.380573	2.380754	2.380934	2.381115	2.381296	2.381476	2.381656	2.381837	181
241	2.382017	2.382197	2.382377	2.382557	2.382737	2.382917	2.383097	2.382277	2.383456	2.383636	180
242	2.383815	2.383995	2.384175	2.384353	2.384533	2.384712	2.384891	2.385070	2.385249	2.385427	179
243	2.385606	2.385785	2.385964	2.386142	2.386321	2.386499	2.386677	2.386855	2.387034	2.387212	178
244	2.387390	2.387568	2.387746	2.387923	2.388101	2.388279	2.388456	2.388634	2.388811	2.388989	178
245	2.389166	2.389343	2.389520	2.389697	2.389874	2.390051	2.390228	2.390405	2.390582	2.390758	177
246	2.390935	2.391112	2.391288	2.391464	2.391641	2.391817	2.391993	2.392169	2.392345	2.392521	176
247	2.392697	2.392873	2.393048	2.393224	2.393400	2.393575	2.393751	2.393926	2.394101	2.394276	176
248	2.394452	2.394627	2.394802	2.394977	2.395152	2.395326	2.395501	2.395676	2.395850	2.396025	175
249	2.396199	2.396374	2.396548	2.396722	2.396869	2.397070	2.397245	2.397418	2.397592	2.397766	174

N°	0	1	2	3	4	5	6	7	8	9	Diff.
250	2.397940	2.398114	2.398287	2.398461	2.398634	2.398808	2.398981	2.399154	2.399327	2.399501	173
251	2.399674	2.399847	2.400020	2.400192	2.400365	2.400538	2.400711	2.400883	2.401056	2.401228	173
252	2.401400	2.401573	2.401745	2.401917	2.402089	2.402261	2.402433	2.402605	2.402777	2.402949	172
253	2.403120	2.403292	2.403464	2.403635	2.403807	2.403978	2.404149	2.404320	2.404492	2.404663	171
254	2.404834	2.405005	2.405175	2.405346	2.405517	2.405688	2.405858	2.406029	2.406199	2.406370	171
255	2.406540	2.400710	2.406881	2.407051	2.407221	2.407391	2.407561	2.407731	2.407900	2.408070	170
256	2.408240	2.408409	2.408579	2.408749	2.408918	2.409087	2.409257	2.409426	2.409595	2.409764	169
257	2.409933	2.410102	2.410271	2.410440	2.410608	2.410777	2.410946	2.411114	2.411283	2.411451	169
258	2.411620	2.411788	2.411956	2.412124	2.412292	2.412460	2.412628	2.412796	2.412964	2.413132	168
259	2.413300	2.413467	2.413635	2.413802	2.413970	2.414137	2.414305	2.414472	2.414639	2.414806	167
260	2.414973	2.415140	2.415307	2.415474	2.415641	2.415808	2.415974	2.416141	2.416308	2.416474	167
261	2.416640	2.416807	2.416973	2.417139	2.417306	2.417472	2.417638	2.417804	2.417970	2.418135	166
262	2.418301	2.418467	2.418633	2.418798	2.418964	2.419129	2.419295	2.419460	2.419625	2.419791	165
263	2.419956	2.420121	2.420286	2.420451	2.420616	2.420781	2.420945	2.421110	2.421275	2.421439	165
264	2.421604	2.421768	2.421933	2.422097	2.422261	2.422426	2.422590	2.422750	2.422918	2.423082	164
265	2.423246	2.423410	2.423573	2.423737	2.423901	2.424064	2.424228	2.424391	2.424555	2.424718	164
266	2.424882	2.425045	2.425208	2.425371	2.425534	2.425697	2.425860	2.426023	2.426186	2.426349	163
267	2.426511	2.426674	2.426836	2.426999	2.427161	2.427324	2.427486	2.427648	2.427811	2.427973	162
268	2.428135	2.428297	2.428459	2.428621	2.428782	2.428844	2.429106	2.429268	2.429429	2.429591	162
269	2.429752	2.429914	2.430075	2.430236	2.430398	2.430559	2.430720	2.430881	2.431042	2.431203	161
270	2.431364	2.431525	2.431685	2.431846	2.432007	2.432167	2.432328	2.432488	2.432649	2.432809	160
271	2.432965	2.433129	2.433290	2.433450	2.433610	2.433770	2.433930	2.434090	2.434249	2.434409	160
272	2.434569	2.434728	2.434888	2.435048	2.435207	2.435366	2.435526	2.435685	2.435844	2.436003	159
273	2.436163	2.436322	2.436481	2.436640	2.436798	2.436957	2.437116	2.437275	2.437433	2.437592	159
274	2.437751	2.437909	2.438067	2.438226	2.438384	2.438542	2.438705	2.438859	2.439010	2.439175	158
275	2.439333	2.439491	2.439648	2.439806	2.439964	2.440122	2.440279	2.440439	2.440594	2.440752	158
276	2.440909	2.441066	2.441224	2.441381	2.441538	2.441695	2.441852	2.442009	2.442166	2.442323	157
277	2.442480	2.442636	2.442793	2.442950	2.443106	2.443263	2.443419	2.443576	2.443732	2.443888	157
278	2.444045	2.444201	2.444357	2.444513	2.444669	2.444825	2.444891	2.445137	2.445293	2.445448	156
279	2.445604	2.445760	2.445915	2.446071	2.446226	2.446382	2.446537	2.446692	2.446848	2.447003	155
280	2.447158	2.447313	2.447468	2.447623	2.447778	2.447933	2.448088	2.448242	2.448397	2.448552	155
281	2.448706	2.448861	2.449015	2.449170	2.449324	2.449478	2.449633	2.449787	2.449941	2.450095	154
282	2.450259	2.450403	2.450557	2.450711	2.450865	2.451018	2.451172	2.451326	2.451479	2.451633	154
283	2.451786	2.451940	2.452093	2.452247	2.452400	2.452553	2.452706	2.452859	2.453012	2.453165	153
284	2.453318	2.453471	2.453624	2.453777	2.453930	2.454082	2.454235	2.454387	2.454540	2.454692	153
285	2.454845	2.454997	2.455149	2.455302	2.455454	2.455606	2.455758	2.455910	2.456062	2.456214	152
286	2.456366	2.456518	2.456670	2.456821	2.456973	2.457125	2.457276	2.457428	2.457579	2.457730	152
287	2.457882	2.458033	2.458184	2.458336	2.458487	2.458638	2.458789	2.458940	2.459091	2.459242	151
288	2.459392	2.459643	2.459694	2.459845	2.459995	2.460146	2.460296	2.460447	2.460597	2.460747	151
289	2.460898	2.461048	2.461198	2.461348	2.461498	2.461649	2.461799	2.461948	2.462098	2.462248	150
290	2.462398	2.462548	2.462697	2.462847	2.462997	2.463146	2.463295	2.463445	2.463594	2.463744	150
291	2.463893	2.464042	2.464191	2.464340	2.464489	2.464638	2.464787	2.464936	2.465085	2.465234	149
292	2.465383	2.465532	2.465680	2.465829	2.465977	2.466125	2.466274	2.466423	2.466571	2.466719	148
293	2.466868	2.467010	2.467164	2.467312	2.467460	2.467608	2.467756	2.467904	2.468052	2.468199	148
294	2.468347	2.468495	2.468643	2.468790	2.468938	2.469085	2.469233	2.469380	2.469527	2.469675	147
295	2.469822	2.469969	2.470116	2.470263	2.470410	2.470557	2.470704	2.470851	2.470998	2.471145	147
296	2.471292	2.471438	2.471585	2.471732	2.471878	2.472024	2.472171	2.472317	2.472464	2.472610	146
297	2.472756	2.472903	2.473049	2.473195	2.473341	2.473487	2.473633	2.473779	2.473925	2.474070	146
298	2.474216	2.474362	2.474508	2.474653	2.474799	2.474944	2.475080	2.475235	2.475381	2.475526	146
299	2.475671	2.475816	2.475962	2.476107	2.476252	2.476396	2.476542	2.476687	2.476832	2.476976	145
300	2.477121	2.477266	2.477411	2.477555	2.477700	2.477844	2.477989	2.478133	2.478278	2.478422	145
301	2.478566	2.478711	2.478855	2.478999	2.479143	2.479287	2.479431	2.479575	2.479719	2.479863	144
302	2.480007	2.480151	2.480294	2.480438	2.480582	2.480725	2.480869	2.481012	2.481156	2.481299	144
303	2.481443	2.481586	2.481729	2.481872	2.482016	2.482159	2.482302	2.482445	2.482588	2.482731	143
304	2.482874	2.483016	2.483159	2.483302	2.483445	2.483587	2.483720	2.483872	2.484015	2.484157	143

N°	0	1	2	3	4	5	6	7	8	9	Diff.
305	2.484300	2.484442	2.484584	2.484727	2.484869	2.485011	2.485153	2.485295	2.485437	2.485579	142
306	2.485721	2.485863	2.486005	2.486147	2.486289	2.486430	2.486572	2.486714	2.486855	2.486997	142
307	2.487138	2.487280	2.487421	2.487563	2.487704	2.487845	2.487986	2.488127	2.488269	2.488409	141
308	2.488551	2.488692	2.488833	2.488973	2.489114	2.489255	2.489396	2.489537	2.489677	2.489818	141
309	2.489958	2.490099	2.490239	2.490280	2.490520	2.490661	2.490801	2.490941	2.491081	2.491222	140
310	2.491362	2.491502	2.491642	2.491782	2.491922	2.492062	2.492201	2.492341	2.492481	2.492621	140
311	2.492760	2.492900	2.493040	2.493179	2.493319	2.493458	2.493597	2.493737	2.493876	2.494015	139
312	2.494155	2.494294	2.494433	2.494572	2.494711	2.494850	2.494989	2.495128	2.495267	2.495406	139
313	2.595544	2.495683	2.495822	2.495960	2.496099	2.496237	2.496376	2.496514	2.496653	2.496791	139
314	2.496930	2.497068	2.497206	2.497344	2.497482	2.497621	2.497759	2.497897	2.498035	2.498173	138
315	2.498311	2.498448	2.498586	2.498724	2.498862	2.498999	2.499137	2.499275	2.499412	2.499549	138
316	2.499687	2.499824	2.499962	2.500099	2.500236	2.500374	2.500511	2.500684	2.500785	2.500922	137
317	2.501059	2.501196	2.501333	2.501470	2.501607	2.501744	2.501880	2.502017	2.502154	2.502290	137
318	2.502427	2.502564	2.502700	2.502837	2.502973	2.503109	2.503246	2.503382	2.503518	2.503654	136
319	2.503791	2.503927	2.504063	2.504199	2.504335	2.504471	2.504607	2.504743	2.504878	2.505014	136
320	2.505150	2.505286	2.505421	2.505557	2.505692	2.505828	2.505963	2.506099	2.506234	2.506369	136
321	2.506505	2.506640	2.506775	2.506911	2.507046	2.507181	2.507316	2.507451	2.507586	2.507721	135
322	2.507856	2.507991	2.508125	2.508260	2.508395	2.508510	2.508664	2.508799	2.508933	2.509068	135
323	2.509202	2.509337	2.509471	2.509606	2.509740	2.509874	2.510008	2.510143	2.510277	2.510411	134
324	2.510545	2.510679	2.510813	2.510947	2.511081	2.511215	2.511348	2.511482	2.511616	2.511749	134
325	2.511883	2.512017	2.512150	2.512284	2.512417	2.512551	2.512684	2.512818	2.512951	2.513084	133
326	2.513218	2.513351	2.513484	2.513617	2.513750	2.513883	2.514016	2.514149	2.514282	2.514415	133
327	2.514548	2.514680	2.514813	2.514946	2.515079	2.515211	2.515344	2.515476	2.515609	2.515741	133
328	2.515874	2.516006	2.516139	2.516271	2.516403	2.516535	2.516668	2.516799	2.516932	2.517064	132
329	2.517196	2.517328	2.517460	2.517592	2.517724	2.517855	2.517987	2.518119	2.518251	2.518382	132
330	2.518514	2.518645	2.518777	2.518909	2.519040	2.519171	2.519303	2.519434	2.519565	2.519697	131
331	2.519828	2.519959	2.520090	2.520221	2.520352	2.520483	2.520614	2.520745	2.520876	2.521007	131
332	2.521138	2.521269	2.521400	2.521530	2.521661	2.521792	2.521922	2.522053	2.522183	2.522314	131
333	2.522444	2.522575	2.522705	2.522835	2.522966	2.523096	2.523226	2.523356	2.523486	2.523616	130
334	2.523746	2.523876	2.524006	2.524136	2.524266	2.524396	2.524526	2.524656	2.524785	2.524915	130
335	2.525045	2.525174	2.525304	2.525433	2.525563	2.525692	2.525822	2.525951	2.526081	2.526210	129
336	2.526339	2.526468	2.526598	2.526727	2.526856	2.526985	2.527114	2.527243	2.527372	2.527501	129
337	2.527630	2.527759	2.527888	2.528016	2.528145	2.528274	2.528402	2.528531	2.528660	2.528788	129
338	2.528917	2.529045	2.529174	2.529302	2.529430	2.529559	2.529687	2.529815	2.529943	2.530072	128
339	2.530200	2.530328	2.530416	2.530584	2.530712	2.530839	2.530968	2.531095	2.531223	2.531351	128
340	2.531479	2.531607	2.531734	2.531862	2.531989	2.532117	2.532245	2.532372	2.532499	2.532627	128
341	2.532754	2.532882	2.533009	2.533136	2.533263	2.533391	2.533518	2.533645	2.533772	2.533899	127
342	2.534026	2.534153	2.534280	2.534407	2.534534	2.534661	2.534787	2.534914	2.535041	2.535167	127
343	2.535294	2.535421	2.535547	2.535674	2.535800	2.535927	2.536053	2.536179	2.536306	2.536432	126
344	2.536558	2.536685	2.536811	2.536937	2.537063	2.537189	2.537315	2.537441	2.537567	2.537693	126
345	2.537819	2.537945	2.538071	2.538197	2.538322	2.538448	2.538574	2.538699	2.538825	2.538951	126
346	2.539076	2.539202	2.539327	2.539452	2.539578	2.539704	2.539828	2.539954	2.540079	2.540204	125
347	2.540329	2.540455	2.540580	2.540705	2.540830	2.540955	2.541080	2.541205	2.541330	2.541454	125
348	2.541579	2.541704	2.541829	2.541953	2.542078	2.542203	2.542327	2.542452	2.542576	2.542701	125
349	2.542825	2.542950	2.543074	2.543199	2.543323	2.543447	2.543571	2.543696	2.543820	2.543044	124
350	2.544068	2.544192	2.544316	2.544440	2.544564	2.544688	2.544812	2.544936	2.545060	2.545183	124
351	2.545307	2.545431	2.545554	2.545678	2.545802	2.545925	2.546049	2.546172	2.546296	2.546419	124
352	2.546543	2.546666	2.546789	2.546913	2.547036	2.547159	2.547282	2.547405	2.547529	2.547652	123
353	2.547775	2.547898	2.548021	2.548144	2.548266	2.548389	2.548512	2.548635	2.548758	2.548881	123
354	2.549003	2.549126	2.549249	2.549371	2.549494	2.549616	2.549739	2.549861	2.549984	2.550106	123
355	2.550228	2.550351	2.550473	2.550595	2.550717	2.550840	2.550962	2.551084	2.551206	2.551328	122
356	2.551450	2.551572	2.551694	2.551816	2.551938	2.552059	2.552181	2.552303	2.552425	2.552546	122
357	2.552668	2.552790	2.552911	2.553033	2.553154	2.553276	2.553397	2.553519	2.553640	2.553762	121
358	2.553883	2.554004	2.554126	2.554247	2.554368	2.554489	2.554610	2.554731	2.554852	2.554973	121
359	2.555094	2.555215	2.555336	2.555457	2.555578	2.555699	2.555820	2.555940	2.556061	2.556182	121

N°	0	1	2	3	4	5	6	7	8	9	Diff.
360	2.556302	2.556423	2.556544	2.556664	2.556785	2.556905	2.557026	2.557146	2.557266	2.557387	120
361	2.557507	2.557627	2.557748	2.557868	2.557988	2.558108	2.558228	2.558348	2.558469	2.558589	120
362	2.558709	2.558828	2.558948	2.559068	2.559188	2.559308	2.559428	2.559548	2.559667	2.559787	120
363	2.559907	2.560026	2.560146	2.560265	2.560385	2.560504	2.560624	2.560743	2.560863	2.560982	119
364	2.561101	2.561221	2.561340	2.561450	2.561578	2.561697	2.561847	2.561936	2.562055	2.562174	119
365	2.562293	2.562412	2.562531	2.562650	2.562768	2.562887	2.563006	2.563125	2.563237	2.563363	119
366	2.563481	2.563600	2.563718	2.563837	2.563955	2.564074	2.564192	2.564311	2.564429	2.564548	119
367	2.564666	2.564784	2.564903	2.565021	2.565139	2.565257	2.565375	2.565494	2.565612	2.565730	118
368	2.565848	2.565966	2.566084	2.566202	2.566320	2.566437	2.566555	2.566673	2.566791	2.566909	118
369	2.567026	2.567144	2.567262	2.567379	2.567497	2.567614	2.567732	2.567849	2.567967	2.568084	118
370	2.568202	2.568319	2.568436	2.568554	2.568671	2.568788	2.568905	2.569023	2.569140	2.569257	117
371	2.569374	2.569491	2.569608	2.569725	2.569842	2.569959	2.570076	2.570193	2.570309	2.570426	117
372	2.570543	2.570660	2.570776	2.570893	2.571010	2.571126	2.571243	2.571359	2.571476	2.571592	117
373	2.571709	2.571825	2.571942	2.572058	2.572174	2.572291	2.572407	2.572523	2.572639	2.572755	116
374	2.572872	2.572988	2.573104	2.573220	2.573336	2.573452	2.573568	2.573684	2.573800	2.573915	116
375	2.574031	2.574147	2.574263	2.574379	2.574494	2.574610	2.574726	2.574841	2.574957	2.575072	116
376	2.575188	2.575303	2.575419	2.575534	2.575650	2.575765	2.575880	2.575996	2.576111	2.576226	115
377	2.576341	2.576456	2.576572	2.576687	2.576802	2.576917	2.577032	2.577147	2.577262	2.577377	115
378	2.577492	2.577607	2.577721	2.577836	2.577951	2.578066	2.578181	2.578295	2.578410	2.578525	115
379	2.578639	2.578754	2.578868	2.578983	2.579097	2.579212	2.579326	2.579441	2.579555	2.579669	114
380	2.579784	2.579898	2.580012	2.580126	2.580240	2.580355	2.580469	2.580583	2.580697	2.580811	114
381	2.580925	2.581039	2.581153	2.581267	2.581381	2.581495	2.581608	2.581722	2.581836	2.581950	114
382	2.582063	2.582177	2.582291	2.582404	2.582518	2.582631	2.582745	2.582858	2.582972	2.583085	113
383	2.583199	2.583312	2.583425	2.583539	2.583652	2.583765	2.583879	2.583992	2.584105	2.584218	113
384	2.584331	2.584444	2.584557	2.584670	2.584785	2.584896	2.585009	2.585122	2.585235	2.585348	113
385	2.585461	2.585573	2.585686	2.585799	2.585912	2.586024	2.586137	2.586250	2.586362	2.586475	113
386	2.586587	2.586700	2.586812	2.586925	2.587037	2.587149	2.587262	2.587374	2.587486	2.587599	112
387	2.587711	2.587823	2.587935	2.588047	2.588160	2.588272	2.588384	2.588496	2.588608	2.588720	112
388	2.588832	2.588944	2.589055	2.589167	2.589279	2.589391	2.589503	2.589614	2.589726	2.589838	112
389	2.589950	2.590061	2.590173	2.590284	2.590396	2.590507	2.590619	2.590730	2.590842	2.590953	112
390	2.590953	2.591176	2.591827	2.591398	2.591510	2.591621	2.591732	2.591843	2.591955	2.592066	111
391	2.592177	2.592288	2.592399	2.592510	2.592621	2.592932	2.592843	2.592954	2.593064	2.593175	111
392	2.593286	2.593397	2.593508	2.593618	2.593729	2.593840	2.593950	2.594061	2.594171	2.594282	111
393	2.594392	2.594503	2.594613	2.594724	2.594834	2.594945	2.595055	2.595165	2.595276	2.595386	110
394	2.595496	2.595606	2.595717	2.595827	2.595937	2.596047	2.596157	2.596267	2.596377	2.596487	110
395	2.596597	2.596707	2.596817	2.596927	2.597037	2.597146	2.597256	2.597366	2.597476	2.597585	110
396	2.597695	2.597805	2.597914	2.598024	2.598134	2.598243	2.598353	2.598462	2.598572	2.598681	110
397	2.598790	2.598900	2.599009	2.599119	2.599228	2.599337	2.599446	2.599556	2.599665	2.599774	109
398	2.599883	2.599992	2.600101	2.600210	2.600319	2.600428	2.600537	2.600646	2.600755	2.600864	109
399	2.600973	2.601082	2.601190	2.601299	2.601408	2.601517	2.601625	2.601734	2.601843	2.601951	109
400	2.602060	2.602168	2.602277	2.602386	2.602494	2.602602	2.602711	2.602819	2.602928	2.603036	108
401	2.603144	2.603253	2.603361	2.603469	2.603577	2.603685	2.603794	2.603902	2.604010	2.604118	108
402	2.604226	2.604334	2.604442	2.604550	2.604658	2.604766	2.604874	2.604982	2.605089	2.605197	108
403	2.605305	2.605413	2.605520	2.605628	2.605736	2.605843	2.605951	2.606059	2.606166	2.606274	108
404	2.606381	2.606489	2.606596	2.606704	2.606811	2.606918	2.607026	2.607133	2.607240	2.607348	107
405	2.607455	2.607562	2.607669	2.607777	2.607884	2.607991	2.608098	2.608205	2.608312	2.608419	107
406	2.608526	2.608633	2.608740	2.608847	2.608954	2.609060	2.609167	2.609274	2.609381	2.609488	107
407	2.609594	2.609701	2.609808	2.609914	2.610021	2.610128	2.610234	2.610341	2.610447	2.610554	107
408	2.610660	2.610767	2.610873	2.610979	2.611086	2.611192	2.611298	2.611405	2.611511	2.611617	106
409	2.611723	2.611829	2.611936	2.612042	2.612148	2.612254	2.612360	2.612466	2.612572	2.612678	106
410	2.612784	2.612890	2.612996	2.613102	2.613207	2.613313	2.613419	2.613525	2.613630	2.613736	106
411	2.613842	2.613947	2.614053	2.614159	2.614264	2.614370	2.614475	2.614581	2.614686	2.614792	106
412	2.614897	2.615003	2.615108	2.615213	2.615319	2.615424	2.615529	2.615634	2.615740	2.615845	105
413	2.615950	2.616055	2.616160	2.616265	2.616370	2.616475	2.616580	2.616685	2.616790	2.616895	105
414	2.617000	2.617105	2.617210	2.617315	2.617420	2.617524	2.617629	2.617734	2.617839	2.617943	105

N°	0	1	2	3	4	5	6	7	8	9	Diff.
415	2.618048	2.618153	2.618257	2.618362	2.618466	2.618571	2.618675	2.618780	2.618884	2.618989	105
416	2.619093	2.619198	2.619302	2.619406	2.619511	2.619615	2.619719	2.619823	2.619928	2.620032	104
417	2.620136	2.620240	2.620344	2.620448	2.620552	2.620656	2.620760	2.620864	2.620968	2.621072	104
418	2.621176	2.621280	2.621384	2.621488	2.621592	2.621695	2.621799	2.621903	2.622007	2.622110	104
419	2.622214	2.622318	2.622421	2.622525	2.622628	2.622732	2.622835	2.622939	2.623042	2.623146	104
420	2.623249	2.623353	2.623456	2.623559	2.623663	2.623766	2.623869	2.623972	2.624076	2.624179	104
421	2.624282	2.624385	2.624488	2.624591	2.624694	2.624798	2.624901	2.625004	2.625107	2.625209	103
422	2.625312	2.625415	2.625518	2.625621	2.625724	2.625827	2.625929	2.626032	2.626135	2.626238	103
423	2.626340	2.626443	2.626546	2.626648	2.626751	2.626853	2.626956	2.627058	2.627161	2.627263	103
424	2.627366	2.627468	2.627571	2.627673	2.627775	2.627878	2.627980	2.628082	2.628184	2.628287	102
425	2.628389	2.628491	2.628593	2.628695	2.628797	2.628901	2.629002	2.629104	2.629206	2.629308	102
426	2.629410	2.629511	2.629613	2.629715	2.629817	2.629919	2.630021	2.630123	2.630224	2.630326	102
427	2.630428	2.630529	2.630631	2.630733	2.630834	2.630936	2.631038	2.631139	2.631241	2.631342	102
428	2.631444	2.631545	2.631647	2.631748	2.631849	2.631951	2.632052	2.632153	2.632255	2.632356	101
429	2.632457	2.632558	2.632660	2.632761	2.632862	2.632963	2.633064	2.633165	2.633266	2.633367	101
430	2.633468	2.633569	2.633670	2.633771	2.633872	2.633973	2.634074	2.634175	2.634276	2.634376	100
431	2.634477	2.634578	2.634679	2.634779	2.634880	2.634981	2.635081	2.635182	2.635283	2.635383	100
432	2.635484	2.635584	2.635685	2.635785	2.635886	2.635986	2.636086	2.636187	2.636287	2.636388	100
433	2.636488	2.636588	2.636688	2.636789	2.636889	2.636989	2.637089	2.637189	2.637289	2.637390	100
434	2.637490	2.637590	2.637690	2.63779o	2.637890	2.637990	2.638090	2.638190	2.638289	2.638389	99
435	2.638489	2.638589	2.638689	2.638789	2.638888	2.638988	2.639088	2.639188	2.639287	2.639387	99
436	2.639486	2.639586	2.639686	2.639785	2.639885	2.639984	2.640084	2.640183	2.640283	2.640382	99
437	2.640481	2.640581	2.640680	2.640779	2.640879	2.640978	2.641077	2.641176	2.641276	2.641375	99
438	2.641474	2.641573	2.641672	2.641771	2.641870	2.641970	2.642069	2.642168	2.642267	2.642366	99
439	2.642464	2.642563	2.642662	2.642761	2.642860	2.642959	2.643058	2.643156	2.643255	2.643354	99
440	2.643453	2.643551	2.643650	2.643749	2.643847	2.643946	2.644044	2.644143	2.644242	2.644340	98
441	2.644439	2.644537	2.644635	2.644734	2.644832	2.644931	2.645029	2.645127	2.645226	2.645324	98
442	2.645422	2.645520	2.645619	2.645717	2.645815	2.645913	2.646011	2.646109	2.646208	2.646306	98
443	2.646404	2.646502	2.646600	2.646698	2.646796	2.646894	2.646991	2.647089	2.647187	2.647285	98
444	2.647383	2.647481	2.647578	2.647676	2.647774	2.647872	2.647969	2.648067	2.648165	2.648262	98
445	2.648360	2.648458	2.648555	2.648653	2.648750	2.648848	2.648945	2.649043	2.649140	2.649237	97
446	2.649335	2.649432	2.649530	2.649627	2.649724	2.649821	2.649919	2.650016	2.650113	2.650210	97
447	2.650307	2.650405	2.650502	2.650599	2.650696	2.650793	2.650890	2.650987	2.651084	2.651181	97
448	2.651278	2.651375	2.651472	2.651569	2.651666	2.651762	2.651859	2.651956	2.652053	2.652150	97
449	2.652246	2.652343	2.652440	2.652536	2.652633	2.652730	2.652826	2.652923	2.653019	2.653116	97
450	2.653212	2.653309	2.653405	2.653502	2.653598	2.653695	2.653791	2.653888	2.653984	2.654080	96
451	2.654176	2.654273	2.654369	2.654465	2.654562	2.654658	2.654574	2.654850	2.654946	2.655042	96
452	2.655138	2.655234	2.655331	2.655427	2.655523	2.655619	2.655714	2.655810	2.655906	2.656002	96
453	2.656098	2.656194	2.656290	2.656386	2.656481	2.656577	2.656673	2.656769	2.656864	2.656960	96
454	2.657056	2.657151	2.657247	2.657343	2.657438	2.657534	2.657629	2.657725	2.657820	2.657916	96
455	2.658011	2.658107	2.658202	2.658298	2.658393	2.658488	2.658584	2.658679	2.658774	2.658870	95
456	2.658965	2.659060	2.659155	2.659250	2.659346	2.659441	2.659536	2.659631	2.659726	2.659821	95
457	2.659916	2.660011	2.660106	2.660201	2.660296	2.660391	2.660486	2.660581	2.660676	2.660771	95
458	2.660865	2.660960	2.661055	2.661150	2.661245	2.661339	2.661434	2.661529	2.661623	2.661718	95
459	2.661813	2.661907	2.662002	2.662096	2.662191	2.662285	2.662380	2.662474	2.662569	2.662663	95
460	2.662758	2.662852	2.662947	2.663041	2.663135	2.663230	2.663324	2.663418	2.663512	2.663607	94
461	2.663701	2.663795	2.663889	2.663983	2.664078	2.664172	2.664266	2.664360	2.664454	2.664548	94
462	2.664642	2.664736	2.664830	2.664924	2.665018	2.665112	2.665206	2.665299	2.665393	2.665487	94
463	2.665581	2.665675	2.665768	2.665862	2.665956	2.666050	2.666143	2.666237	2.666331	2.666424	94
464	2.666518	2.666612	2.666705	2.666799	2.666892	2.666986	2.667079	2.667173	2.667266	2.667359	94
465	2.667453	2.667546	2.667640	2.667733	2.667826	2.667920	2.668013	2.668106	2.668199	2.668293	93
466	2.668386	2.668479	2.668572	2.668665	2.668758	2.668852	2.668945	2.669038	2.669131	2.669224	93
467	2.669317	2.669410	2.669503	2.669596	2.669689	2.669782	2.669874	2.669967	2.670060	2.670153	93
468	2.670246	2.670339	2.670431	2.670524	2.670617	2.670710	2.670802	2.670895	2.670988	2.671080	93
469	2.671173	2.671265	2.671358	2.671451	2.671543	2.671636	2.671728	2.671821	2.671913	2.672005	93

N°	0	1	2	3	4	5	6	7	8	9	Diff.
470	2.672098	2.672190	2.672283	2.672375	2.672467	2.672560	2.672652	2.672744	2.672836	2.672929	92
471	2.673021	2.673113	2.673205	2.673297	2.673390	2.673482	2.673574	2.673666	2.673738	2.673850	92
472	2.673942	2.674034	2.674126	2.674218	2.674315	2.674402	2.674494	2.674586	2.674677	2.674769	92
473	2.674861	2.674953	2.675045	2.675136	2.675228	2.675320	2.675412	2.675503	2.675595	2.675687	92
474	2.675778	2.675870	2.675961	2.676053	2.676145	2.676236	2.676328	2.676419	2.676511	2.676602	92
475	2.676694	2.676785	2.676876	2.676968	2.677059	2.677150	2.677242	2.677333	2.677424	2.677516	91
476	2.677607	2.677698	2.677789	2.677881	2.677972	2.678063	2.678154	2.678245	2.678336	2.678427	91
477	2.678518	2.678609	2.678700	2.678791	2.678882	2.678973	2.679064	2.679155	2.679246	2.679337	91
478	2.679428	2.679519	2.679610	2.679700	2.679791	2.679882	2.679973	2.680063	2.680154	2.680245	91
479	2.680335	2.680426	2.680517	2.680607	2.680698	2.680789	2.680879	2.680970	2.681060	2.681151	91
480	2.681241	2.681332	2.681422	2.681513	2.681603	2.681693	2.681784	2.681874	2.681964	2.682055	90
481	2.682145	2.682235	2.682326	2.682416	2.682506	2.682596	2.682686	2.682777	2.682867	2.682957	90
482	2.683047	2.683137	2.683227	2.683317	2.683407	2.683497	2.683587	2.683677	2.683767	2.683857	90
483	2.683947	2.684037	2.684127	2.684217	2.684307	2.684396	2.684486	2.684576	2.684666	2.684756	90
484	2.684845	2.684935	2.685025	2.685114	2.685204	2.685294	2.685383	2.685472	2.685563	2.685652	90
485	2.685742	2.685831	2.685921	2.686010	2.686100	2.686189	2.686279	2.686368	2.686457	2.686547	89
486	2.686636	2.686726	2.686815	2.686904	2.686994	2.687083	2.687172	2.687261	2.687351	2.687440	89
487	2.687529	2.687618	2.687707	2.687796	2.687885	2.687975	2.688064	2.688153	2.688242	2.688331	89
488	2.688420	2.688509	2.688598	2.688687	2.688776	2.688865	2.688953	2.689042	2.689131	2.689220	89
489	2.689309	2.689398	2.689486	2.689575	2.689664	2.689753	2.689841	2.689930	2.690019	2.690107	89
490	2.690196	2.690285	2.690373	2.690462	2.690550	2.690639	2.690727	2.690816	2.690905	2.690993	89
491	2.691081	2.691170	2.691258	2.691347	2.691435	2.691523	2.691612	2.691700	2.691788	2.691877	88
492	2.691965	2.692053	2.692142	2.692230	2.692318	2.692406	2.692494	2.692583	2.692671	2.692759	88
493	2.692847	2.692935	2.693023	2.693111	2.693199	2.693287	2.693375	2.693463	2.693551	2.693639	88
494	2.693727	2.693815	2.693903	2.693991	2.694078	2.694166	2.694254	2.694342	2.694430	2.694517	88
495	2.694605	2.694693	2.694781	2.694868	2.694956	2.695044	2.695131	2.695219	2.695306	2.695394	88
496	2.695482	2.695569	2.695657	2.695744	2.695832	2.695919	2.696007	2.696094	2.696182	2.696269	87
497	2.696356	2.696444	2.696531	2.696618	2.696706	2.696793	2.696880	2.696968	2.697055	2.697142	87
498	2.697229	2.697316	2.697404	2.697491	2.697578	2.697665	2.697752	2.697839	2.697926	2.698013	87
499	2.698100	2.698188	2.698275	2.698362	2.698448	2.698535	2.698622	2.698709	2.698736	2.698883	87
500	2.698970	2.699057	2.699144	2.699230	2.699317	2.699404	2.699491	.2699578	2.699664	2.699751	87
501	2.699838	2.699924	2.700011	2.700098	2.700184	2.700271	2.700357	2.700444	2.700531	2.700617	87
502	2.700704	2.700790	2.700877	2.700963	2.701050	2.701136	2.701222	2.701309	2.701395	2.701482	86
503	2.701568	2.701654	2.701741	2.701827	2.701913	2.701999	2.702086	2.702172	2.702258	2.702344	86
504	2.702430	2.702517	2.702603	2.702689	2.702775	2.702861	2.702947	2.703033	2.703119	2.703205	86
505	2.703291	2.703377	2.703463	2.703549	2.703635	2.703721	2.703807	2.703893	2.703979	2.704065	86
506	2.704150	2.704236	2.704322	2.704408	2.704494	2.704579	2.704665	2.704751	2.704837	2.704922	86
507	2.705008	2.705094	2.705179	2.705265	2.705350	2.705436	2.705522	2.705607	2.705693	2.705778	86
508	2.705864	2.705949	2.706035	2.706120	2.706205	2.706291	2.706376	2.706462	2.706547	2.706632	85
509	2.706718	2.706803	2.706888	2.706974	2.707059	2.707144	2.707229	2.707315	2.707400	2.707485	85
510	2.707570	2.707655	2.707740	2.707826	2.707911	2.707996	2.708081	2.708166	2.708251	2.708336	85
511	2.708421	2.708506	2.708591	2.708676	2.708761	2.708846	2.708931	2.709015	2.709100	2.709185	85
512	2.709270	2.709355	2.709440	2.709524	2.709609	2.709694	2.709779	2.709863	2.709948	2.710033	85
513	2.710117	2.710202	2.710287	2.710371	2.710455	2.710540	2.710625	2.710710	2.710794	2.710879	85
514	2.710963	2.711048	2.711132	2.711216	2.711301	2.711385	2.711470	2.711554	2.711638	2.711723	84
515	2.711807	2.711891	2.711976	2.712060	2.712144	2.712229	2.712313	2.712397	2.712481	2.712565	84
516	2.712650	2.712734	2.712818	2.712902	2.712986	2.713070	2.713154	2.713238	2.713322	2.713406	84
517	2.713490	2.713574	2.713658	2.713742	2.713836	2.713910	2.713994	2.714078	2.714162	2.714246	84
518	2.714330	2.714414	2.714497	2.714581	2.714665	2.714749	2.714832	2.714916	2.715000	2.715084	84
519	2.715167	2.715251	2.715335	2.715418	2.715502	2.715586	2.715669	2.715753	2.715836	2.715920	84
520	2.716003	2.716087	2.716170	2.716254	2.716337	2.716421	2.716504	2.716588	2.716671	2.716754	83
521	2.716838	2.716921	2.717004	2.717088	2.717171	2.717254	2.717338	2.717421	2.717504	2.717587	83
522	2.717670	2.717754	2.717837	2.717920	2.718003	2.718086	2.718169	2.718253	2.718336	2.718419	83
523	2.718502	2.718585	2.718668	2.718571	2.718834	2.718917	2.719000	2.719083	2.719165	2.719248	83
524	2.719331	2.719414	2.719497	2.719580	2.719663	2.719745	2.719828	2.719911	2.719994	2.720077	83

N°	0	1	2	3	4	5	6	7	8	9	Diff.
525	2.720159	2.720242	2.720325	2.720407	2.720490	2.720573	2.720655	2.720738	2.720821	2.720903	83
526	2.720986	2.721068	2.721151	2.721233	2.721316	2.721398	2.721481	2.721563	2.721646	2.721728	82
527	2.721811	2.721893	2.721975	2.722058	2.722140	2.722222	2.722305	2.722387	2.722469	2.722552	82
528	2.722634	2.722716	2.722798	2.722881	2.722963	2.723045	2.723127	2.723209	2.723291	2.723374	82
529	2.723456	2.723538	2.723620	2.723702	2.723784	2.723866	2.723948	2.724030	2.724112	2.724194	82
530	2.724276	2.724358	2.724440	2.724522	2.724603	2.724685	2.724767	2.724849	2.724931	2.725013	82
531	2.725094	2.725176	2.725258	2.725340	2.725421	2.725503	2.725585	2.725667	2.725748	2.725830	82
532	2.725912	2.725993	2.726075	2.726156	2.726238	2.726320	2.726401	2.726483	2.726564	2.726646	82
533	2.726727	2.726809	2.726890	2.726972	2.727053	2.727134	2.727216	2.727297	2.727379	2.727420	81
534	2.727541	2.727623	2.727704	2.727785	2.727866	2.727948	2.728029	2.728110	2.728191	2.728273	81
535	2.728354	2.728435	2.728516	2.728597	2.728678	2.728759	2.728841	2.728922	2.729003	2.729084	81
536	2.729165	2.729246	2.729327	2.729408	2.729489	2.729570	2.729651	2.729732	2.729813	2.729893	81
537	2.729974	2.730055	2.730136	2.730217	2.730298	2.730378	2.730459	2.730540	2.730621	2.730702	81
538	2.730782	2.730863	2.730944	2.731024	2.731105	2.731186	2.731266	2.731347	2.731428	2.731508	81
539	2.731589	2.731669	2.731750	2.731830	2.731911	2.731991	2.732072	2.732152	2.732233	2.732313	81
540	2.732394	2.732474	2.732555	2.732635	2.732715	2.732796	2.732876	2.732956	2.733037	2.733177	80
541	2.733797	2.733277	2.733358	2.733438	2.733518	2.733598	2.733679	2.733759	2.733839	2.733919	80
542	2.733999	2.734079	2.734159	2.734240	2.734320	2.734400	2.734480	2.734560	2.734640	2.734720	80
543	2.734800	2.734880	2.734960	2.735040	2.735120	2.735200	2.735279	2.735359	2.735439	2.735519	80
544	2.735599	2.735679	2.735758	2.735838	2.735918	2.735998	2.736078	2.736157	2.736237	2.736317	80
545	2.736396	2.736476	2.736556	2.736635	2.736715	2.736795	2.736874	2.736954	2.737034	2.737113	80
546	2.737193	2.737272	2.737352	2.737431	2.737511	2.737590	2.737670	2.737749	2.737829	2.737908	79
547	2.737987	2.738067	2.738146	2.738225	2.738305	2.738384	2.738463	2.738543	2.738622	2.738701	79
548	2.738781	2.738860	2.738939	2.739018	2.739097	2.739177	2.739256	2.739335	2.739414	2.739493	79
549	2.739572	2.739651	2.739730	2.739810	2.739889	2.739968	2.740047	2.740126	2.740205	2.740284	79
550	2.740363	2.740442	2.740521	2.740599	2.740678	2.740757	2.740836	2.740915	2.740994	2.741073	79
551	2.741152	2.741230	2.741309	2.741388	2.741467	2.741546	2.741624	2.741703	2.741782	2.741860	79
152	2.741939	2.742018	2.742096	2.742175	2.742254	2.742332	2.742411	2.742489	2.742568	2.742647	79
553	2.742725	2.742804	2.742882	2.742961	2.743039	2.743118	2.743196	2.743275	2.743353	2.743431	78
554	2.743510	2.743588	2.743666	2.743745	2.743823	2.743902	2.743980	2.744058	2.744136	2.744215	78
555	2.744293	2.744371	2.744449	2.744528	2.744606	2.744684	2.744762	2.744840	2.744919	2.744997	78
556	2.745075	2.745153	2.745231	2.745309	2.745387	2.745465	2.745543	2.745621	2.745699	2.745777	78
557	2.745855	2.745933	2.746011	2.746089	2.746167	2.746245	2.746323	2.746401	2.747479	2.746556	78
558	2.746634	2.746712	2.746790	2.746868	2.746945	2.747023	2.747101	2.747179	2.747256	2.747334	78
559	2.747412	2.747489	2.747567	2.747645	2.747722	2.747800	2.747878	2.747955	2.748033	2.748110	78
560	2.748188	2.748266	2.748343	2.748421	2.748498	2.748576	2.748653	2.748731	2.748808	2.748885	77
561	2.748963	2.749040	2.749118	2.749195	2.749272	2.749350	2.749427	2.749504	2.749582	2.749659	77
562	2.749736	2.749814	2.749891	2.749968	2.750045	2.750123	2.750200	2.750277	2.750354	2.750431	77
563	2.750508	2.750586	2.750663	2.750740	2.750817	2.750894	2.750971	2.751048	2.751125	2.751202	77
564	2.751279	2.751356	2.751433	2.751510	2.751587	2.751664	2.751741	2.751818	2.751895	2.751972	77
565	2.752048	2.752125	2.752202	2.752279	2.752356	2.752433	2.752509	2.752586	2.752663	2.752740	77
566	2.752816	2.752893	2.752970	2.753047	2.753123	2.753200	2.753277	2.753354	2.753430	2.753506	77
567	2.753583	2.753660	2.753736	2.753813	2.753889	2.753966	2.754042	2.754119	2.754195	2.754272	77
568	2.754348	2.754425	2.754501	2.754578	2.754654	2.754730	2.754807	2.754883	2.754960	2.755035	76
569	2.755112	2.755189	2.755265	2.755341	2.755417	2.755494	2.755570	2.755646	2.755722	2.755799	76
570	2.755875	2.755951	2.756027	2.756103	2.756180	2.756256	2.756332	2.756408	2.756484	2.756560	76
571	2.756636	2.756712	2.756788	2.756878	2.756940	2.757016	2.757092	2.757168	2.757244	2.757320	76
572	2.757396	2.757472	2.757548	2.757624	2.757700	2.757773	2.757851	2.757927	2.758003	2.758079	76
573	2.758155	2.758230	2.758306	2.758382	2.758458	2.758539	2.758609	2.758685	2.758761	2.758836	76
574	2.758912	2.758988	2.759063	2.759139	2.759214	2.759290	2.759366	2.759441	2.759517	2.759592	76
575	2.759668	2.759743	2.759819	2.759894	2.759970	2.760045	2.760121	2.760196	2.760272	2.760347	75
576	2.760422	2.760498	2.760573	2.760649	2.760724	2.760799	2.760875	2.760950	2.761025	2.761101	75
577	2.761176	2.761251	2.761326	2.761402	2.761477	2.761552	2.761627	2.761702	2.761778	2.761853	75
578	2.761928	2.762003	2.762078	2.762153	2.762228	2.762303	2.762378	2.762453	2.762529	2.762604	75
579	2.762679	2.762754	2.762829	2.762904	2.762978	2.763053	2.763128	2.763203	2.763278	2.763353	75

N°	0	1	2	3	4	5	6	7	8	9	Diff.
580	2.763428	2.763503	2.763578	2.763653	2.763727	2.763802	2.763877	2.763952	2.764027	2.764101	75
581	2.764176	2.764251	2.764326	2.764400	2.764475	2.764550	2.764624	2.764699	2.764774	2.764848	75
5	2.764923	2.764998	2.765072	2.765147	2.765221	2.765296	2.765370	2.765445	2.765520	2.765594	75
583	2.765669	2.765743	2.765818	2.765892	2.765966	2.766041	2.766115	2.766190	2.766264	2.766338	74
584	2.766413	2.766487	2.766562	2.766636	2.766710	2.766785	2.766859	2.766933	2.767007	2.767082	74
585	2.767156	2.767230	2.767304	2.767379	2.767453	2.767525	2.767601	2.767675	2.767749	2.767823	74
586	2.767878	2.767972	2.768046	2.768120	2.768194	2.768268	2.768343	2.768416	2.768490	2.768564	74
587	2.768638	2.768711	2.768786	2.768860	2.768934	2.769008	2.769082	2.769156	2.769230	2.769303	74
588	2.769377	2.769451	2.769525	2.769599	2.769673	2.769746	2.769820	2.769894	2.769968	2.770042	74
589	2.770115	2.770189	2.770263	2.770336	2.770410	2.770484	2.770557	2.770631	2.770705	2.770778	74
590	2.770852	2.770926	2.770999	2.771073	2.771146	2.771220	2.771293	2.771367	2.771440	2.771514	74
591	2.771587	2.771661	2.771734	2.771808	2.771881	2.771955	2.772028	2.772102	2.772175	2.772248	73
592	2.772322	2.772395	2.772468	2.772542	2.772615	2.772688	2.772762	2.772835	2.772908	2.772981	73
593	2.773055	2.773128	2.773201	2.773274	2.773348	2.773421	2.773494	2.773567	2.773640	2.773713	73
594	2.773786	2.773860	2.773933	2.774006	2.774079	2.774152	2.774225	2.774298	2.774371	2.774444	73
595	2.774517	2.774590	2.774663	2.774736	2.774809	2.774882	2.774955	2.775028	2.775100	2.775173	73
596	2.775240	2.775319	2.775392	2.775465	2.775538	2.775610	2.775683	2.775756	2.775829	2.775902	73
597	2.775974	2.776047	2.776120	2.776193	2.776265	2.776338	2.776411	2.776483	2.776556	2.776629	73
598	2.776701	2.776774	2.776846	2.776919	2.776992	2.777064	2.777137	2.777209	2.777282	2.777354	73
599	2.777427	2.777499	2.777572	2.777644	2.777717	2.777789	2.777862	2.777934	2.778006	2.778079	72
600	2.778151	2.778224	2.778296	2.778368	2.778441	2.778513	2.778585	2.778658	2.778730	2.778802	72
601	2.778874	2.778947	2.779019	2.779091	2.779163	2.779236	2.779308	2.779380	2.779452	2.779524	72
602	2.779596	2.779669	2.779741	2.779813	2.779885	2.779957	2.780029	2.780101	2.780173	2.780245	72
603	2.780317	2.780389	2.780461	2.780533	2.780605	2.780677	2.780749	2.780821	2.780893	2.780965	72
604	2.781037	2.781109	2.781181	2.781253	2.781324	2.781396	2.781468	2.781540	2.781612	2.781684	72
605	2.781755	2.781827	2.781899	2.781971	2.782042	2.782114	2.782186	2.782258	2.782329	2.782401	72
606	2.782473	2.782544	2.782616	2.782688	2.782759	2.782831	2.782902	2.782974	2.783046	2.783117	71
607	2.783189	2.783260	2.783332	2.783403	2.783475	2.783546	2.783618	2.783689	2.783761	2.783832	71
608	2.783904	2.783975	2.784046	2.784118	2.784189	2.784261	2.784332	2.784403	2.784475	2.784546	71
609	2.784617	2.784689	2.784760	2.784831	2.784902	2.784974	2.785045	2.785116	2.785187	2.785259	71
610	2.785330	2.785401	2.785472	2.785543	2.785615	2.785686	2.785757	2.785828	2.785899	2.785970	71
611	2.786041	2.786112	2.786183	2.786254	2.786325	2.786396	2.786467	2.786538	2.786609	2.786680	71
612	2.786751	2.786822	2.786893	2.786964	2.787035	2.787106	2.787177	2.787248	2.787319	2.787390	71
613	2.787460	2.787531	2.787602	2.787673	2.787744	2.787815	2.787885	2.787956	2.788027	2.788098	71
614	2.788168	2.788239	2.788310	2.788381	2.788451	2.788522	2.788593	2.788663	2.788734	2.788804	71
615	2.788875	2.788946	2.789016	2.789087	2.789152	2.789228	2.789299	2.789369	2.789440	2.789510	71
616	2.789581	2.789651	2.789722	2.789792	2.789863	2.789933	2.790003	2.790074	2.790144	2.790215	70
617	2.790285	2.790356	2.790426	2.790496	2.790567	2.790637	2.790707	2.790778	2.790848	2.790918	70
618	2.790988	2.791059	2.791129	2.791199	2.791269	2.791340	2.791410	2.791480	2.791550	2.791620	70
619	2.791691	2.791761	2.791831	2.791901	2.791971	2.792041	2.792111	2.792181	2.792252	2.792322	70
620	2.792392	2.792462	2.792532	2.792602	2.792672	2.792742	2.792812	2.792882	2.792952	2.793022	70
621	2.793092	2.793162	2.793231	2.793301	2.793371	2.793441	2.793511	2.793581	2.793651	2.793721	70
622	2.793790	2.793860	2.793930	2.794000	2.794070	2.794139	2.794209	2.794279	2.794349	2.794418	70
623	2.794488	2.794558	2.794627	2.794697	2.794767	2.794836	2.794906	2.794970	2.795045	2.795115	70
624	2.795185	2.795254	2.795324	2.795393	2.795463	2.795532	2.795602	2.795671	2.795741	2.795810	70
625	2.795880	2.795949	2.796019	2.796088	2.796158	2.796227	2.796297	2.796366	2.796436	2.796505	69
626	2.796574	2.796644	2.796713	2.796782	2.796852	2.796921	2.796990	2.797060	2.797129	2.797198	69
627	2.797268	2.797337	2.797406	2.797475	2.797545	2.797614	2.797683	2.797752	2.797821	2.797890	69
628	2.797960	2.798029	2.798098	2.798167	2.798236	2.798305	2.798374	2.798443	2.798512	2.798582	69
629	2.798651	2.798720	2.798789	2.798858	2.798927	2.798996	2.799065	2.799134	2.799203	2.799272	69
630	2.799341	2.799409	2.799478	2.799547	2.799616	2.799685	2.799754	2.799823	2.799802	2.799960	69
631	2.800029	2.800098	2.800167	2.800236	2.800305	2.800373	2.800442	2.800511	2.800580	2.800648	69
632	2.800717	2.800789	2.800854	2.800923	2.800992	2.801060	2.801129	2.801198	2.801267	2.801335	69
633	2.801404	2.801472	2.801541	2.801609	2.801678	2.801747	2.801815	2.801884	2.801952	2.802021	69
634	2.802089	2.802158	2.802226	2.802295	2.802363	2.802432	2.802500	2.802568	2.802637	2.802705	68

N°	0	1	2	3	4	5	6	7	8	9	Diff.
635	2.802774	2.802842	2.802910	2.802979	2.803047	2.803116	2.803184	2.803252	2.803321	2.803389	68
636	2.803457	2.803525	2.803594	2.803662	2.803730	2.803798	2.803867	2.803935	2.804003	2.804071	68
637	2.804139	2.804208	2.804276	2.804344	2.804412	2.804480	2.804548	2.804616	2.804685	2.804753	68
638	2.804821	2.804889	2.804957	2.805025	2.805093	2.805161	2.805229	2.805297	2.805365	2.805433	68
639	2.805501	2.805569	2.805637	2.805705	2.805773	2.805840	2.805908	2.805976	2.806044	2.806112	68
640	2.806180	2.806248	2.806316	2.806384	2.806451	2.806519	2.806587	2.806655	2.806723	2.806790	68
641	2.806858	2.806926	2.806994	2.807061	2.807129	2.807197	2.807264	2.807332	2.807400	2.807467	68
642	2.807535	2.807603	2.807670	2.807738	2.807806	2.807873	2.807941	2.808008	2.808076	2.808143	68
643	2.808211	2.808279	2.808346	2.808414	2.808481	2.808548	2.808616	2.808683	2.808751	2.808818	68
644	2.808886	2.808953	2.809021	2.809088	2.809155	2.809223	2.809290	2.809358	2.809425	2.809492	67
645	2.809560	2.809627	2.809694	2.809762	2.809829	2.809896	2.809963	2.810031	2.810098	2.810165	67
646	2.810235	2.810300	2.810367	2.810434	2.810501	2.810568	2.810636	2.810703	2.810770	2.810837	67
647	2.810904	2.810971	2.811038	2.811106	2.811173	2.811240	2.811307	2.811374	2.811441	2.811508	67
648	2.811575	2.811642	2.811709	2.811776	2.811843	2.811910	2.811977	2.812044	2.812111	2.812178	67
649	2.812245	2.812312	2.812378	2.812445	2.812512	2.812579	2.812646	2.812713	2.812780	2.812846	67
650	2.812913	2.812980	2.813047	2.813114	2.813180	2.813247	2.813314	2.813381	2.813447	2.813514	67
651	2.813581	2.813648	2.813714	2.813781	2.813848	2.813914	2.813980	2.814048	2.814114	2.814181	67
652	2.814248	2.814314	2.814381	2.814447	2.814514	2.814580	2.814647	2.814714	2.814780	2.814847	67
653	2.814913	2.814980	2.815046	2.815112	2.815179	2.815246	2.815312	2.815378	2.815445	2.815511	66
654	2.815578	2.815644	2.815710	2.815777	2.815843	2.815910	2.815976	2.816042	2.816109	2.816175	66
655	2.816241	2.816308	2.816374	2.816440	2.816506	2.816573	2.816639	2.816705	2.816771	2.816838	66
656	2.816904	2.816970	2.817036	2.817102	2.817169	2.817235	2.817301	2.817367	2.817433	2.817499	66
657	2.817565	2.817631	2.817698	2.817764	2.817830	2.817896	2.817962	2.818028	2.818094	2.818100	66
658	2.818226	2.818292	2.818358	2.818424	2.818490	2.818556	2.818622	2.818668	2.818754	2.818819	66
659	2.818885	2.818951	2.819017	2.819083	2.819149	2.819215	2.819281	2.819346	2.819412	2.819478	66
660	2.819544	2.819610	2.819675	2.819741	2.819807	2.819873	2.819939	2.820004	2.820070	2.820136	66
661	2.820201	2.820267	2.820333	2.820398	2.820464	2.820536	2.820595	2.920661	2.820727	2.820792	66
662	2.820858	2.820924	2.820989	2.821055	2.821120	2.821186	2.821251	2.821317	2.821482	2.821448	66
663	2.821513	2.821579	2.821644	2.821710	2.821775	2.821841	2.821906	2.821972	2.822037	2.822103	65
664	2.822168	2.822233	2.822299	2.822364	2.822430	2.822495	2.822560	2.822626	2.822691	2.822756	65
665	2.822822	2.822887	2.822952	2.823017	2.823083	2.823148	2.823213	2.823279	2.823344	2.823409	65
666	2.823474	2.823539	2.823605	2.823670	2.823735	2.823800	2.823865	2.823930	2.823996	2.824061	65
667	2.824126	2.824191	2.824256	2.824321	2.824386	2.824451	2.824516	2.824581	2.824646	2.824711	65
668	2.824776	2.824841	2.824906	2.824971	2.825036	2.825101	2.825166	2.825231	2.825296	2.825361	65
669	2.825426	2.825401	2.825556	2.825620	2.825686	2.825751	2.825815	2.825880	2.825945	2.826010	65
670	2.826075	2.826140	2.826204	2.826269	2.826334	2.826399	2.826464	2.826528	2.826593	2.826658	65
671	2.826722	2.826787	2.826852	2.826917	2.826981	2.827046	2.827111	2.827175	2.827240	2.827305	65
672	2.827369	2.827434	2.827498	2.827563	2.827628	2.827692	2.827757	2.827821	2.827886	2.827950	65
673	2.828015	2.828080	2.828144	2.828209	2.828273	2.828338	2.820402	2.828466	2.828531	2.828595	64
674	2.828660	2.828724	2.828789	2.828853	2.828918	2.828982	2.829046	2.829111	2.829175	2.829239	64
675	2.829304	2.829368	2.829432	2.829497	2.829561	2.829625	2.829690	2.829754	2.829818	2.829882	64
676	2.829947	2.830011	2.830075	2.830139	2.830204	2.830268	2.830332	2.830396	2.830460	2.830524	64
677	2.830589	2.830653	2.830717	2.830781	2.830845	2.830909	2.830973	2.831037	2.831102	2.831166	64
678	2.831230	2.831294	2.831358	2.831422	2.831486	2.831550	2.831614	2.831678	2.831742	2.831806	64
679	2.831870	2.831934	2.831998	2.832062	2.832125	2.832189	2.832253	2.832317	2.832381	2.832445	64
680	2.832509	2.832573	2.832637	2.832700	2.832764	2.832828	2.832892	2.832956	2.833019	2.833083	64
681	2.833147	2.833211	2.833275	2.833338	2.833402	2.833466	2.833530	2.833593	2.833657	2.833721	64
682	2.833784	2.833848	2.833912	2.833975	2.834039	2.834103	2.834166	2.834230	2.834293	2.834357	64
683	2.834421	2.834484	2.834548	2.834611	2.834675	2.834738	2.834802	2.834866	2.834929	2.834993	64
684	2.835056	2.835120	2.835183	2.835246	2.835310	2.835373	2.835437	2.835500	2.835564	2.835627	63
685	2.835691	2.835754	2.835817	2.835881	2.835944	2.836007	2.836071	2.836134	2.836197	2.836261	63
686	2.836324	2.836387	2.836451	2.836514	2.836577	2.836640	2.836704	2.836767	2.836830	2.836893	63
687	2.836957	2.837070	2.837083	2.837116	2.837209	2.837273	2.837336	2.837399	2.837462	2.837525	63
688	2.837588	2.837652	2.837715	2.837778	2.837841	2.837904	2.837967	2.838030	2.838093	2.838156	63
689	2.838219	2.838282	2.838345	2.838408	2.838471	2.838534	2.838597	2.838660	2.838723	2.838786	63

N°	0	1	2	3	4	5	6	7	8	9	Diff.
690	2.838849	2.838912	2.838975	2.839038	2.839101	2.839164	2.839227	2.839289	2.839352	2.839415	63
691	2.839478	2.839541	2.839604	2.839667	2.839729	2.839792	2.839855	2.839918	2.839981	2.840043	63
692	2.840106	2.840169	2.840232	2.840294	2.840357	2.840420	2.840482	2.840545	2.840608	2.840671	63
693	2.840733	2.840796	2.840859	2.840921	2.840984	2.841046	2.841109	2.841172	2.841234	2.841297	63
694	2.841359	2.841422	2.841485	2.841547	2.841610	2.841672	2.841735	2.841797	2.841860	2.841922	63
695	2.841985	2.842047	2.842110	2.842172	2.842235	2.842297	2.842360	2.842422	2.842484	2.842543	62
696	2.842609	2.842672	2.842734	2.842796	2.842859	2.842921	2.842983	2.843046	2.843108	2.843170	62
697	2.843233	2.843295	2.843357	2.843420	2.843482	2.843544	2.843606	2.843669	2.843731	2.843793	62
698	2.843855	2.843918	2.843980	2.844042	2.844104	2.844166	2.844229	2.844291	2.844353	2.844415	62
699	2.844477	2.844539	2.844601	2.844663	2.844726	2.844788	2.844851	2.844912	2.844974	2.845036	62
700	2.845098	2.845160	2.845222	2.845284	2.845346	2.845408	2.845470	2.845532	2.845594	2.845656	62
701	2.845718	2.845780	2.845842	2.845902	2.845966	2.846028	2.846090	2.846151	2.846213	2.846275	62
702	2.846337	2.846399	2.846461	2.846523	2.846584	2.846646	2.846708	2.846770	2.846832	2.846893	62
703	2.846955	2.847017	2.847079	2.847141	2.847202	2.847264	2.847326	2.847388	2.847449	2.847511	62
704	2.847573	2.847634	2.847696	2.847758	2.847819	2.847881	2.847943	2.848004	2.848066	2.848127	62
705	2.848189	2.848251	2.848312	2.848374	2.848435	2.848497	2.848559	2.848620	2.848682	2.848743	62
706	2.848805	2.848866	2.848928	2.848989	2.849051	2.849112	2.849174	2.849235	2.849296	2.849358	61
707	2.849419	2.849481	2.849542	2.849604	2.849665	2.849726	2.849788	2.849849	2.849911	2.849972	61
708	2.850033	2.850095	2.850156	2.850217	2.850279	2.850340	2.850401	2.850462	2.850524	2.850585	61
709	2.850646	2.850707	2.850769	2.850830	2.850891	2.850952	2.851014	2.851075	2.851136	2.851197	61
710	2.851258	2.851319	2.851381	2.851442	2.851503	2.851564	2.851625	2.851686	2.851747	2.851808	61
711	2.851870	2.851931	2.851992	2.852053	2.852114	2.852175	2.852236	2.852297	2.852358	2.852419	61
712	2.852480	2.852541	2.852602	2.852663	2.852724	2.852785	2.852846	2.852907	2.852968	2.853029	61
713	2.853089	2.853150	2.853211	2.853272	2.853333	2.853394	2.853455	2.853516	2.853576	2.853637	61
714	2.853698	2.853759	2.853820	2.853881	2.853941	2.854002	2.854063	2.854124	2.854184	2.854245	61
715	2.854306	2.854367	2.854427	2.854488	2.854549	2.854610	2.854670	2.854731	2.854792	2.854852	61
716	2.854913	2.854974	2.855034	6.855095	2.855156	2.855216	2.855277	2.855337	2.855398	2.855459	61
717	2.855519	2.855580	2.855640	2.855701	2.855761	2.855822	2.855882	2.855943	2.856003	2.856064	61
718	2.856124	2.856185	2.856245	2.856306	2.856466	2.856427	2.856487	2.856548	2.856608	2.856668	60
719	2.856729	2.856789	2.856850	2.856910	2.856970	2.857031	2.857091	2.857151	2.857212	2.857272	60
720	2.857332	2.857393	2.857453	2.857513	2.857574	2.857634	2.857694	2.857754	2.857815	2.857875	60
721	2.857935	2.857995	2.858056	2.858116	2.858176	2.858236	2.858296	2.858357	2.858417	2.858477	60
722	2.858537	2.858597	2.858657	2.858718	2.858778	2.858838	2.858898	2.858958	2.859018	2.859078	60
723	2.859138	2.859198	2.859258	2.859318	2.859378	2.859438	2.859499	2.859559	2.859619	2.859679	60
724	2.859739	2.859798	2.859858	2.859918	2.859978	2.860038	2.860098	2.860158	2.860218	2.860278	60
725	2.860338	2.860398	2.860458	2.860518	2.860578	2.860637	2.860697	2.860757	2.860817	2.860877	60
726	2.860937	2.860996	2.861056	2.861116	2.861176	2.861236	2.861295	2.861355	2.861415	2.861475	60
727	2.861534	2.861594	2.861654	2.861714	2.861773	2.861833	2.861893	2.861952	2.862012	2.862072	60
728	2.862131	2.862191	2.862251	2.862310	2.862370	2.862430	2.862489	2.862549	2.862608	2.862668	60
729	2.862727	2.862787	2.862847	2.862906	2.862966	2.863025	2.863085	2.863144	2.863204	2.863263	60
730	2.863323	2.863382	2.863442	2.863501	2.863561	2.863620	2.863680	2.863739	2.863798	2.863858	59
731	2.863917	2.863977	2.864036	2.864096	2.864155	2.864214	2.864274	2.864333	2.864392	2.864452	59
732	2.864511	2.864570	2.864630	2.864689	2.864748	2.864808	2.864867	2.864926	2.864985	2.865045	59
733	2.865104	2.865163	2.865222	2.865282	2.865341	2.865400	2.865459	2.865518	2.865578	2.865637	59
734	2.865696	2.865755	2.865814	2.865873	2.865933	2.865992	2.866051	2.866110	2.866169	2.866228	59
735	2.866287	2.866346	2.866405	2.866465	2.866524	2.866583	2.866642	2.866701	2.866760	2.866819	59
736	2.866878	2.866937	2.866996	2.867055	2.867114	2.867173	2.867232	2.867291	2.867350	2.867409	59
737	2.867467	2.867526	2.867585	2.867644	2.867703	2.867762	2.867821	2.867880	2.867939	2.867997	59
738	2.868056	2.868115	2.868174	2.868233	2.868292	2.868350	2.868409	2.868468	2.868527	2.868586	59
739	2.868644	2.868703	2.868762	2.868821	2.868879	2.868938	2.868997	2.869056	2.869114	2.869173	59
740	2.869232	2.869290	2.869349	2.869408	2.869466	2.869525	2.869584	2.869642	2.869701	2.869760	59
741	2.869818	2.869877	2.869935	2.869994	2.870053	2.870111	2.870170	2.870228	2.870287	2.870345	59
742	2.870404	2.870462	2.870521	2.870579	2.870638	2.870696	2.870755	2.870813	2.870872	2.870930	58
743	2.870989	2.871047	2.871106	2.871164	2.871223	2.871281	2.871339	2.871398	2.871456	2.871515	58
744	2.871573	2.871631	2.871690	2.871748	2.871806	2.871865	2.871923	2.871981	2.872040	2.872098	58

N°	0	1	2	3	4	5	6	7	8	9	Diff.
745	2.872156	2.872215	2.872273	2.872331	2.872389	2.872448	2.872506	2.872564	2.872622	2.872681	58
746	2.872739	2.872797	2.872855	2.872913	2.872972	2.873030	2.873088	2.873146	2.873204	2.873262	58
747	2.873321	2.873379	2.873437	2.873495	2.873553	2.873611	2.873669	2.873727	2.873785	2.873843	58
748	2.873902	2.873960	2.874018	2.874076	2.874134	2.874192	2.874250	2.874308	2.874366	2.874424	58
749	2.874482	2.874540	2.874598	2.874656	2.874714	2.874772	2.874830	2.874887	2.874945	2.875003	58
750	2.875061	2.875119	2.875177	2.875235	2.875293	2.875351	2.875409	2.875466	2.875524	2.875582	58
751	2.875640	2.875698	2.875756	2.875813	2.875871	2.875929	2.875987	2.876044	2.876102	2.876160	58
752	2.876218	2.876276	2.876333	2.876391	2.876449	2.876506	2.876564	2.876622	2.876680	2.876737	58
753	2.876795	2.876853	2.876910	2.876968	2.877026	2.877083	2.877141	2.877198	2.877256	2.877314	58
754	2.877371	2.877429	2.877486	2.877544	2.877603	2.877659	2.877717	2.877774	2.877832	2.877889	58
755	2.877943	2.878004	2.878062	2.878119	2.878177	2.878234	2.878292	2.878349	2.878407	2.878464	57
756	2.878522	2.878579	2.878637	2.878694	2.878751	2.878809	2.878866	2.878922	2.878981	2.879038	57
757	2.879096	2.879153	2.879211	2.879268	2.879325	2.879383	2.879440	2.879497	2.879555	2.879612	57
758	2.879669	2.879726	2.879784	2.879841	2.079898	2.879956	2.880010	2.880070	2.880127	2.880185	57
759	2.880242	2.880299	2.880356	2.880413	2.880471	2.880528	2.880585	2.880642	2.880699	2.880756	57
760	2.880814	2.880871	2.880928	2.880985	2.881042	2.881099	2.881156	2.881213	2.881270	2.881328	57
761	2.881385	2.881442	2.881499	2.881556	2.881613	2.881670	2.881727	2.881784	2.881841	2.881898	57
762	2.881955	2.882012	2.882069	2.882126	2.882183	2.682240	2.882297	2.882354	2.882411	2.882408	57
763	2.882524	2.882581	2.882638	2.882695	2.882752	2.882809	2.882866	2.882923	2.882980	2.883036	57
764	2.883093	2.883150	2.883207	2.883264	2.883321	2.883377	2.883434	2.883491	2.883548	2.883605	57
765	2.883661	2.883718	2.883775	2.883832	2.883889	2.883945	2.884002	2.884059	2.884115	2.884172	57
766	2.884229	2.884285	2.884342	2.884399	2.884455	2.884514	2.884569	2.884625	2.884682	2.884739	57
767	2.884795	2.884852	2.884909	2.884965	2.885022	2.885078	2.885135	2.885191	2.885248	2.885305	57
768	2.885361	2.885418	2.885474	2.885531	2.885587	2.885644	2.885700	2.885757	2.885813	2.885870	57
769	2.885926	2.885983	2.886039	2.886096	2.886152	2.886209	2.886265	2.886321	2.886378	2.886434	56
770	2.886490	2.886547	2.886603	2.886660	2.886716	2.886773	2.886829	2.886885	2.886942	2.886998	56
771	2.887054	2.887111	2.887167	2.887223	2.887280	2.887336	2.887392	2.887448	2.887505	2.887561	56
772	2.887617	2.887673	2.887730	2.887786	2.887842	2.887898	2.887955	2.888011	2.888067	2.888123	56
773	2.888179	2.888236	2.888292	2.888348	2.888404	2.888460	2.888516	2.888573	2.888629	2.888685	56
774	2.888741	2.888797	2.888853	2.888909	2.888965	2.889021	2.889077	2.889133	2.889190	2.889246	56
775	2.889302	2.889358	2.889414	2.889470	2.889526	2.889582	2.889638	2.889694	2.889750	2.889806	56
776	2.889862	2.889918	2.889974	2.890030	2.890086	2.890141	2.890197	2.890253	2.890309	2.890365	56
777	2.890421	2.890477	2.890533	2.890589	2.890644	2.890700	2.890755	2.890812	2.890868	2.890924	56
778	2.890980	2.891035	2.891091	2.891147	2.891203	2.891259	2.891314	2.891370	2.891426	2.891482	56
779	2.891537	2.891593	2.891649	2.891705	2.891760	2.891816	2.891872	2.891927	2.891983	2.892039	56
780	2.892095	2.892150	2.892206	2.892262	2.892317	2.892373	2.892428	2.892484	2.892540	2.892595	56
781	2.892651	2.892707	2.892762	2.892818	2.892873	2.892929	2.892985	2.893040	2.893096	2.893151	56
782	2.893207	2.893262	2.893318	2.893373	2.893429	2.893484	2.893540	2.893595	2.893651	2.893706	56
783	2.893762	2.893717	2.893873	2.893928	2.893984	2.894039	2.894094	2.894150	2.894205	2.894261	55
784	2.894316	2.894371	2.894427	2.894482	2.894538	2.894593	2.894648	2.894704	2.894759	2.894814	55
785	2.894870	2.894925	2.894980	2.895036	2.895091	2.895146	2.895201	2.895257	2.895312	2.895367	55
786	2.895422	2.895478	2.895533	2.895588	2.895643	2.895699	2.895754	2.893809	2.895864	2.895919	55
787	2.895975	2.896030	2.896085	2.896140	2.896195	2.896251	2.896306	2.896361	2.896416	2.896471	55
788	2.896526	2.896581	2.896636	2.896691	2.896747	2.896802	2.896857	2.896912	2.896967	2.897022	55
789	2.897077	2.897132	2.897187	2.897242	2.897297	2.897352	2.897407	2.897462	2.897517	2.897572	55
790	2.897627	2.897682	2.897737	2.897792	2.897847	2.897902	2.897957	2.898012	2.898067	2.898122	55
791	2.898176	2.898231	2.898286	2.898341	2.898396	2.898451	2.898506	2.898561	2.898615	2.898670	55
792	2.898725	2.898780	2.898835	2.898890	2.898944	2.898999	2.899054	2.899109	2.899164	2.899218	55
793	2.899273	2.899328	2.899383	2.899437	2.899492	2.899547	2.899602	2.899656	2.899711	2.899766	55
794	2.899820	2.899875	2.899930	2.899985	2.900039	2.900094	2.900149	2.900203	2.900258	2.900312	55
795	2.900367	2.900422	2.900476	2.900531	2.900586	2.900640	2.900695	2.900749	2.900804	2.900858	55
796	2.900913	2.900968	2.901022	2.901077	2.901131	2.901186	2.901240	2.901295	2.901349	2.901404	55
797	2.901458	2.901513	2.901567	2.901622	2.901676	2.901731	2.901785	3.901840	2.901894	2.901948	54
798	2.902003	2.902057	2.902112	2.902166	2.902220	2.902275	2.902329	2.902384	2.902438	2.902492	54
799	2.902547	2.902601	2.902655	2.902710	2.902764	2.902818	2.902873	2.902927	2.902981	2.903036	54

N°	0	1	2	3	4	5	6	7	8	9	Diff.
800	2.903090	2.903144	2.903198	2.903253	2.903307	2.903361	2.903416	2.903470	2.903524	2.903578	54
801	2.903632	2.903687	2.903741	2.903795	2.903849	2.903903	2.903958	2.904012	2.904066	2.904120	54
802	2.904174	2.904228	2.904283	2.904337	2.904391	2.904445	2.904499	2.904553	2.904607	2.904661	54
803	2.904715	2.904770	2.904824	2.904878	2.904932	2.904986	2.905040	2.905094	2.905148	2.905202	54
804	2.905256	2.905310	2.905364	2.905418	2.905472	2.905526	2.905580	2.905634	2.905688	2.905742	54
805	2.905796	2.905850	2.905904	2.905958	2.906012	2.906065	2.906119	2.906173	2.906227	2.906281	54
806	2.906335	2.906389	2.906443	2.906497	2.906550	2.906604	2.906658	2.906712	2.906766	2.906820	54
807	2.906873	2.906927	2.906981	2.907035	2.907089	2.907142	2.907196	2.907250	2.907304	2.907358	54
808	2.907411	2.907465	2.907519	2.907573	2.907626	2.907680	2.907734	2.907787	2.907841	2.907895	54
809	2.907948	2.908002	2.908056	2.908109	2.908163	2.908217	2.908270	2.908324	2.908378	2.908431	54
810	2.908485	2.908539	2.908592	2.908646	2.908699	2.908753	2.908807	2.908860	2.908914	2.908967	54
811	2.909021	2.909074	2.909128	2.909181	2.909235	2.909288	2.909342	2.909395	2.909449	2.909502	54
812	2.909556	2.909609	2.909663	2.909716	2.909770	2.909823	2.909877	2.909930	2.909984	2.910037	53
813	2.910090	2.910144	2.910197	2.910251	2.910304	2.910358	2.910411	2.910464	2.910518	2.910571	53
814	2.910624	2.910678	2.910731	2.910784	2.910838	2.910891	2.910944	2.910998	2.911051	2.911104	53
815	2.911158	2.911211	2.911264	2.911317	2.911371	2.911424	2.911477	2.911530	2.911584	2.911637	53
816	2.911690	2.911743	2.911797	2.911850	2.911903	2.911956	2.912009	2.912063	2.912116	2.912169	53
817	2.912222	2.912275	2.912328	2.912381	2.912435	2.912488	2.912541	2.912594	2.912647	2.912700	53
818	2.912753	2.912806	2.912859	2.912912	2.912966	2.913019	2.913072	2.913125	2.913178	2.913231	53
819	2.913284	2.913337	2.913390	2.913443	2.913496	2.913549	2.913602	2.913655	2.913708	2.913761	53
820	2.913814	2.913867	2.913920	2.913973	2.914026	2.914079	2.914131	2.914184	2.914237	2.914290	53
821	2.914343	2.914396	2.914449	2.914502	2.914555	2.914608	2.914660	2.914713	2.914766	2.914819	53
822	2.914872	2.914925	2.914977	2.915030	2.915083	2.915136	2.915189	2.915241	2.915294	2.915347	53
823	2.915400	2.915453	2.915505	2.915558	2.915611	2.915664	2.915716	2.915769	2.915822	2.915874	53
824	2.915927	2.915980	2.916033	2.916085	2.916138	2.916191	2.916243	2.916296	2.916349	2.916401	53
825	2.916454	2.916507	2.916559	2.916612	2.916664	2.916717	2.916770	2.916822	2.916875	2.916927	53
826	2.916980	2.917033	2.917085	2.917138	2.917190	2.917243	2.917295	2.917348	2.917400	2.917453	53
827	2.917505	2.917558	2.917610	2.917663	2.917715	2.917768	2.917820	2.917873	2.917925	2.917978	52
828	2.918030	2.918083	2.918135	2.918188	2.918240	2.918292	2.918345	2.918397	2.918450	2.918502	52
829	2.918554	2.918607	2.918659	2.918712	2.918764	2.918816	2.918869	2.918921	2.918973	2.919026	52
830	2.919078	2.919130	2.919183	2.919235	2.919287	2.919340	2.919392	2.919444	2.919496	2.919549	52
831	2.919601	2.919653	2.919705	2.919758	2.919810	2.919862	2.919914	2.919967	2.920019	2.920071	52
832	2.920123	2.920175	2.920228	2.920280	2.920332	2.920384	2.920436	2.920489	2.920545	2.920593	52
833	2.920645	2.920697	2.920749	2.920801	2.920853	2.920906	2.920958	2.921010	2.921062	2.921114	52
834	2.921166	2.921218	2.921270	2.921322	2.921374	2.921426	2.921478	2.921530	2.921582	2.921634	52
835	2.921686	2.921738	2.921790	2.921842	2.921894	2.921946	2.921998	2.922050	2.922102	2.922154	52
836	2.922206	2.922258	2.922310	2.922362	2.922414	2.922466	2.922518	2.922570	2.922622	2.922674	52
837	2.922725	2.922777	2.922829	2.922881	2.922933	2.922985	2.923037	2.923088	2.923140	2.923192	52
838	2.923244	2.923296	2.923348	2.923399	2.923451	2.923503	2.923555	2.923607	2.923658	2.923710	52
839	2.923762	2.923814	2.923865	2.923917	2.923969	2.924021	2.924072	2.924124	2.924176	2.924228	52
840	2.924279	2.924331	2.924383	2.924434	2.924486	2.924538	2.924589	2.924641	2.924693	2.924744	52
841	2.924796	2.924848	2.924899	2.924951	2.925002	2.925054	2.925106	2.925157	2.925209	2.925260	52
842	2.925312	2.925364	2.925415	2.925467	2.925518	2.925570	2.925621	2.925673	2.925724	2.925776	52
843	2.925828	2.925879	2.925930	2.925982	2.926034	2.926085	2.926137	2.926188	2.926239	2.926291	51
844	2.926342	2.926394	2.926445	2.926497	2.926548	2.926600	2.926951	2.926702	2.926754	2.926805	51
845	2.926857	2.926908	2.926959	2.927011	2.927062	2.927114	2.927165	2.927216	2.927268	2.927319	51
946	2.927370	2.927422	2.927473	2.927524	2.927576	2.927627	2.927678	2.927730	2.927781	2.927832	51
847	2.927883	2.927935	2.927986	2.928037	2.928088	2.928140	2.928191	2.928242	2.928293	2.928345	51
848	2.928396	2.928447	2.928498	2.928549	2.928601	2.928652	2.928703	2.928754	2.928805	2.928856	51
849	2.928908	2.928959	2.929010	2.929061	2.929112	2.929163	2.929214	2.929266	2.929317	2.929368	51
850	2.929419	2.929470	2.929521	2.929572	2.929623	2.929674	2.929725	2.929776	2.929827	2.929878	51
851	2.929930	2.929981	2.930032	2.930083	2.930134	2.930185	2.930236	2.930287	2.930338	2.930389	51
852	3.930440	2.930491	2.930540	2.930592	2.930643	2.930694	2.930745	2.930796	2.930847	2.930898	51
853	2.930949	2.931000	2.931051	2.931102	2.931153	2.931205	2.931254	2.931305	2.931356	2.931407	51
854	2.931458	2.931509	2.931560	2.931610	2.931661	2.931712	2.931763	2.931814	2.931864	2.931915	51

N°	0	1	2	3	4	5	6	7	8	9	Diff.
855	2.931966	2.932017	2.932068	2.932118	2.932169	2.932220	2.932271	2.932321	2.932372	2.932423	51
856	2.932474	2.932524	2.932575	2.932626	2.932677	2.932727	2.932778	2.932829	2.932879	2.932930	51
857	2.932981	2.933033	2.933082	2.933133	2.933183	2.933234	2.933285	2.933335	2.933386	2.933437	51
858	2.933487	2.933538	2.933588	2.933639	2.933690	2.933740	2.933791	2.933841	2.933892	2.933943	51
859	2.933993	2.934044	2.934094	2.934145	2.934195	2.934246	2.934296	2.934347	2.934397	2.934448	51
860	2.934498	2.934549	2.934599	2.934650	2.934700	2.934751	2.934801	2.934852	2.934902	2.934953	50
861	2.935003	2.935054	2.935104	2.935154	2.935205	2.935255	2.935306	2.935356	2.935406	2.935457	50
862	2.935507	2.935558	2.935608	2.935658	2.935709	2.935759	2.935809	2.935860	2.935910	2.935960	50
863	2.936011	2.936061	2.936111	2.936162	2.936212	2.936262	2.936313	2.936363	2.936413	2.936463	50
864	2.936514	2.936564	2.936614	2.936664	2.936715	2.936765	2.936815	2.936865	2.936916	2.936969	50
865	2.937016	2.937066	2.937116	2.937167	2.937217	2.937267	2.937317	2.937367	2.937418	2.937468	50
866	2.937518	2.937568	2.937618	2.937668	2.937718	2.937769	2.937819	2.937869	2.937919	2.937969	50
867	2.938019	2.938069	2.938119	2.938169	2.938219	2.938269	2.938319	2.938370	2.938420	2.938470	50
868	2.938520	2.938570	2.938620	2.938670	2.938720	2.938770	2.938820	2.938870	2.938920	2.938970	50
869	2.939020	2.939070	2.939120	2.939170	2.939220	2.939270	2.939319	2.939369	2.939419	2.939469	50
870	2.939519	2.939569	2.939619	2.939669	2.939719	2.939769	2.939819	2.939868	2.939918	2.939968	50
871	2.940018	2.940068	2.940118	2.940168	2.940218	2.940267	2.940317	2.940366	2.940417	2.940467	50
872	2.940516	2.940566	2.940616	2.940666	2.940716	2.940765	2.940815	2.940865	2.940915	2.940964	50
873	2.941014	2.941064	2.941114	2.941163	2.941213	2.941263	2.941313	2.941362	2.941412	2.941462	50
874	2.941511	2.941561	2.941611	2.941660	2.941710	2.941760	2.941809	2.941859	2.941909	2.941958	50
875	2.942008	2.942058	2.942107	2.942157	2.942206	2.942256	2.942300	2.942355	2.942405	2.942454	50
876	2.942504	2.942554	2.942603	2.942653	2.942702	2.942752	2.942801	2.942851	2.942900	2.942950	50
877	2.943000	2.943049	2.943099	2.943148	2.943198	2.943247	2.942397	2.943346	2.943397	2.944445	49
878	2.943494	2.943544	2.943593	2.943643	2.943692	2.943742	2.943791	2.943841	2.943890	2.943939	49
879	2.943989	2.944038	2.944088	2.944137	2.944186	2.944236	2.944285	2.944335	2.944384	2.944433	49
880	2.944483	2.944532	2.944581	2.944631	2.944690	2.944729	2.944779	2.944828	2.944877	2.944927	49
881	2.944976	2.945025	2.945074	2.945124	2.945173	2.945222	2.945272	2.945321	2.945370	2.945419	49
882	2.945469	2.945518	2.945567	2.945616	2.945665	2.945715	2.945764	2.945813	2.945863	2.945911	49
883	2.945961	2.946010	2.946059	2.946108	2.946157	2.946207	2.946256	2.946305	2.946354	2.946403	49
884	2.946452	2.946501	2.946550	2.946600	2.946649	2.946698	2.946747	2.946796	2.946845	2.946894	49
885	2.946943	2.946992	2.947041	2.947090	2.947139	2.947189	2.947238	2.947287	2.947336	2.947385	49
886	2.947434	2.947483	2.947532	2.947581	2.947630	2.947679	2.947728	2.947777	2.947826	2.647875	49
887	2.947924	2.947973	2.948021	2.948070	2.948119	2.948168	2.948217	2.948266	2.948315	2.948364	49
888	2.948413	2.948462	2.948511	2.948560	2.948608	2.948657	2.948700	2.948755	2.948804	2.948853	49
889	2.948902	2.948951	2.948999	2.949048	2.949097	2.949146	2.949195	2.949244	2.949292	2.949341	49
890	2.949390	2.949439	2.949488	2.949539	2.949585	2.949633	2.949683	2.949731	2.949780	2.949829	49
891	2.949078	2.949926	2.949975	2.950023	2.950073	2.950121	2.950170	2.950219	2.950267	2.950316	49
892	2.950365	2.950413	2.950462	2.950511	2.950560	2.950608	2.950657	2.950705	2.950754	2.650803	49
893	2.950859	2.950900	2.950946	2.950997	2.951047	2.951095	2.951143	2.951192	2.951240	2.951289	49
894	2.951337	2.951386	2.951435	2.951483	2.951532	2.951580	2.951629	2.951677	2.951726	2.951774	49
895	2.951823	2.951872	2.951920	2.951969	2.952017	2.952066	2.952114	2.952163	2.952211	2.952259	48
896	2.952328	2.952356	2.952405	2.952453	2.952502	2.952550	2.952699	2.952647	2.952696	2.952744	48
897	2.952792	2.952841	2.952889	2.952938	2.952986	2.953034	2.953083	2.953131	2.953180	2.953228	48
898	2.953276	2.953325	2.953373	2.953421	2.953470	2.953518	2.953566	2.953615	2.953663	2.953711	48
899	2.953760	2.953808	2.953856	2.953905	2.953953	2.954001	2.954049	2.954098	2.954246	2.954194	48
900	2.954242	2.954291	2.954339	2.954387	2.954435	2.954484	2.954532	2.954580	2.954628	2.954677	48
901	2.954725	2.954773	2.954811	2.954869	2.954918	2.954966	2.955014	2.955062	2.955110	2.955185	48
902	2.955206	2.955255	2.955303	2.955351	2.955399	2.955447	2.955495	2.955543	2.955591	2.955640	48
903	2.955688	2.955736	2.955784	2.955832	2.955880	2.955928	2.955976	2.956024	2.956072	2.956120	48
904	2.956168	2.956216	2.956264	2.956312	2.956360	2.956409	2.956457	2.956505	2.956553	2.956601	48
905	2.956649	2.956697	2.956744	2.956792	2.956840	2.956888	2.956936	2.956984	2.957032	2.957080	48
906	2.957128	2.957176	2.957224	2.957272	2.957320	2.957368	2.957416	2.957462	2.957511	2.957559	48
907	2.957607	2.957655	2.957707	2.957751	2.957799	2.957847	2.957894	2.957942	2.957990	2.958038	48
908	2.958086	2.958134	2.958181	2.958229	2.958277	2.958325	2.958373	2.958420	2.958468	2.958516	48
909	2.958564	2.958612	2.958659	2.958707	2.958755	2.958803	2.958850	2.958898	2.958946	2.958994	48

N°	0	1	2	3	4	5	6	7	8	9	Diff.
910	2.959041	2.959089	2.959137	2.959184	2.959232	2.959280	2.959328	2.959375	2.959423	2.959471	48
911	2.959518	2.959566	2.959614	2.959661	2.959709	2.959757	2.959804	2.959852	2.959900	2.959947	48
912	2.959995	2.960042	2.960090	2.960138	2.960185	2.960233	2.960280	2.960328	2.960376	2.960423	48
913	2.960471	2.960518	2.960566	2.960613	2.960661	2.960708	2.960756	2.960804	2.960851	2.960899	48
914	2.960946	2.960994	2.961041	2.961089	2.961136	2.961184	2.961231	2.961279	2.961326	2.961374	47
915	2.961421	2.961468	2.961516	2.961563	2.961611	2.961658	2.961706	2.961753	2.961801	2.961848	47
916	2.961895	2.961943	2.961990	2.962038	2.962085	2.962132	2.962180	2.962227	2.962275	2.962322	47
917	2.962369	2.962417	2.962464	2.962511	2.962559	2.962606	2.962653	2.962701	2.962748	2.962795	47
918	2.962843	2.962890	2.962927	2.962985	2.963032	2.963079	2.963126	2.963174	2.963221	2.963268	47
919	2.963315	2.963363	2.963410	2.963457	2.963504	2.963552	2.963599	2.963646	2.963693	2.963741	47
920	2.963788	2.963835	2.963882	2.963929	2.963977	2.964024	2.964071	2.964118	2.964165	2.964212	47
921	2.964260	2.964307	2.964354	2.964401	2.964448	2.964495	2.964542	2.964590	2.964637	2.964684	47
922	2.964731	2.964778	2.964825	2.964872	2.964919	2.964966	2.965013	2.965060	2.965108	2.965155	47
923	2.965202	2.965249	2.965296	2.965343	2.965390	2.965437	2.965484	2.965531	2.965578	2.965625	47
924	2.965672	2.965719	2.965766	2.965813	2.965860	2.965907	2.965954	2.966001	2.966048	2.966095	47
925	2.966142	2.966189	2.966236	2.966283	2.966329	2.966376	2.966423	2.966470	2.966511	2.966564	47
926	2.966611	2.966658	2.966705	2.966752	2.966798	2.966845	2.966892	2.966939	2.966986	2.967033	47
927	2.967080	2.967127	2.967173	2.967220	2.967267	2.967314	2.967361	2.967408	2.967454	2.967501	47
928	2.967548	2.967595	2.967642	2.967688	2.967735	2.967782	2.967829	2.967875	2.967922	2.967969	47
929	2.968016	2.968062	2.968107	2.968156	2.968203	2.968249	2.968296	2.968343	2.968389	2.968436	47
930	2.968483	2.968530	2.968576	2.968623	2.968670	2.968716	2.968763	2.968810	2.968856	2.968903	47
931	2.968950	2.968996	2.969042	2.969090	2.969136	2.969183	2.969229	2.969276	2.969323	2.969369	47
932	2.969416	2.969462	2.969509	2.969556	2.969602	2.969649	2.969695	2.969742	2.969788	2.969835	47
933	2.969882	2.969928	2.969975	2.970031	2.970068	2.970114	2.970161	2.970207	2.970254	2.970300	47
934	2.970347	2.970393	2.970440	2.970486	2.970533	2.970579	2.970626	2.970672	2.970719	2.970765	46
935	2.970812	2.970858	2.970904	2.970951	2.970997	2.971044	2.971090	2.971137	2.971183	2.971224	46
936	2.971276	2.971322	2.971369	2.971415	2.971461	2.971508	2.971554	2.971600	2.971647	2.971693	46
937	2.971740	2.971786	2.971832	2.971879	2.971925	2.971971	2.972018	2.972064	2.972110	2.972156	46
938	2.972203	2.972249	2.972295	2.972342	2.972388	2.972434	2.972480	2.972527	2.972573	2.972619	46
939	2.972666	2.972712	2.972758	2.972804	2.972851	2.972897	2.972945	2.972989	2.973035	2.973082	46
940	2.973128	2.973174	2.973220	2.973260	2.973313	2.973359	2.973405	2.973451	2.973497	2.973543	46
941	2.973590	2.973636	2.973682	2.973728	2.973774	2.973820	2.973866	2.973913	2.973959	2.974005	46
942	2.975051	2.974097	2.974343	2.974189	2.974235	2.974281	2.974327	2.974373	2.974420	2.974466	46
943	2.974512	2.974558	2.974604	2.974650	2.974696	2.974742	2.974788	2.974834	2.974880	2.974926	46
944	2.974972	2.975018	2.975064	2.975110	2.975156	2.975202	2.975248	2.975294	2.975340	2.975386	46
945	2.975432	2.975478	2.975524	2.975570	2.975616	2.975661	2.975707	2.975753	2.975799	2.975845	46
946	2.975890	2.975937	2.975983	2.976029	2.976075	2.976121	2.976166	2.976212	2.976258	2.976304	46
947	2.976350	2.976396	2.976442	2.976487	2.976533	2.976579	2.976625	2.976671	2.976717	2.976762	46
948	2.976808	2.976854	2.976900	2.976940	2.976991	2.977037	2.977083	2.977129	2.977175	2.977220	46
949	2.977266	2.977312	2.977358	2.977403	2.977449	2.977495	2.977541	2.977586	2.977632	2.977678	46
950	2.977724	2.977769	2.977815	2.977861	2.976906	2.977952	2.977998	2.978043	2.978089	2.978135	46
951	2.978180	2.978226	2.978272	2.978317	2.978363	2.978409	2.978454	2.978500	2.978546	2.978591	46
952	2.978637	2.978683	2.978728	2.978774	2.978819	2.978865	2.978911	2.978956	2.979002	2.979047	46
953	2.979093	2.979138	2.979184	2.979230	2.979275	2.979321	2.979366	2.979412	2.979457	2.979503	46
954	2.979548	2.979594	2.979639	2.979685	2.979730	2.979776	2.979821	2.979867	2.979912	2.979958	46
955	2.980003	2.980049	2.980094	2.980140	2.980185	2.980231	2.980276	2.980372	2.980367	2.980412	45
956	2.980458	2.980503	2.980549	2.980594	2.980640	2.980685	2.980730	2.980776	2.980821	2.980867	45
957	2.980912	2.980957	2.981003	2.981048	2.981093	2.981139	2.981184	2.981229	2.981275	2.981320	45
958	2.981365	2.981411	2.981456	2.981501	2.981547	2.981592	2.981637	2.981683	2.981728	2.981773	45
959	2.981819	2.981864	2.981909	2.981954	2.982000	2.982045	2.982090	2.982135	2.982181	2.982226	45
960	2.982271	2.982316	2.982362	2.982407	2.982452	2.982497	2.982543	2.982588	2.982633	2.982678	45
961	2.982723	2.982769	2.982814	2.982859	2.982904	2.982949	2.982994	2.983040	2.983085	2.983130	45
962	2.983175	2.983220	2.983265	2.983310	2.983356	2.983401	2.983446	2.983491	2.983536	2.983581	45
963	2.983626	2.983671	2.983716	2.983762	2.983807	2.983852	2.983897	2.983942	2.983987	2.984032	45
964	2.984077	2.984122	2.984167	2.984212	2.984257	2.984302	2.984347	2.984392	2.984437	2.984482	45

N°	0	1	2	3	4	5	6	7	8	9	Diff.
965	2.984527	2.984572	2.984617	2.984662	2.984707	2.984752	2.984797	2.984842	2.984887	2.984932	45
966	2.984977	2.985022	2.985067	2.985112	2.985157	2.985202	2.985247	2.985292	2.985337	2.985382	45
967	2.985426	2.985471	2.985516	2.985561	2.985606	2.985651	2.985696	2.985741	2.985786	2.985830	45
968	2.985875	2.985920	2.985965	2.986010	2.986055	2.986100	2.986144	2.986189	2.986234	2.986279	45
969	2.986324	2.986369	2.986413	2.986458	2.986503	2.986548	2.986593	2.986637	2.986682	2.986727	45
970	2.986772	2.986816	2.986861	2.986906	2.986951	2.986995	2.987040	2.987085	2.987130	2.987174	45
971	2.987219	2.987264	2.987309	2.987353	2.987398	2.987443	2.987487	2.987532	2.987577	2.987622	45
972	2.987666	2.987711	2.987756	2.987800	2.987845	2.987890	2.987934	2.987979	2.988024	2.988068	45
973	2.988113	2.988157	2.988202	2.988247	2.988291	2.988336	2.988381	2.988425	2.988470	2.988514	45
974	2.988559	2.988603	2.988648	2.988693	2.988737	2.988782	2.988826	2.988871	2.988915	2.988960	45
975	2.989005	2.989049	2.989094	2.989138	2.989183	2.989227	2.989272	2.989316	2.989361	2.989405	45
976	2.989450	2.989494	2.989539	2.989583	2.989628	2.989672	2.989717	2.989761	2.989806	2.989850	44
977	2.989895	2.989939	2.989983	2.990028	2.990072	2.990117	2.990161	2.990206	2.990250	2.990294	44
978	2.990339	2.990383	2.990428	2.990472	2.990516	2.990561	2.990605	2.990650	2.990694	2.990738	44
979	2.990783	2.990827	2.990871	2.990916	2.990960	2.991004	2.991049	2.991093	2.991137	2.991182	44
980	2.991226	2.991270	2.991315	2.991359	2.991403	2.991448	2.991492	2.991536	2.991580	2.991625	44
981	2.991669	2.991713	2.991757	2.991802	2.991846	2.991890	2.991934	2.991979	2.992023	2.992067	44
982	2.992111	2.992156	2.992200	2.992244	2.992288	2.992333	2.992377	2.992421	2.992465	2.992509	44
983	2.992553	2.992598	2.992642	2.992686	2.992730	2.992774	2.992818	2.992863	2.992907	2.992951	44
984	2.992995	2.993039	2.993083	2.993127	2.993172	2.993216	2.993260	2.993304	2.993348	2.993392	44
985	2.993436	2.993480	2.993524	2.993568	2.993613	2.993657	2.993701	2.993745	2.993789	2.993835	44
986	2.993877	2.993921	2.993965	2.994009	2.994053	2.994097	2.994141	2.994185	2.994229	2.994273	44
987	2.994317	2.994361	2.994405	2.994449	2.994493	2.994537	2.994581	2.994625	2.994669	2.994713	44
988	2.994757	2.994801	2.994845	2.994889	2.994933	2.994977	2.995021	2.995064	2.995108	2.995152	44
989	2.995196	2.995240	2.995284	2.995328	2.995372	2.995416	2.995460	2.995504	2.995547	2.995591	44
990	2.995635	2.995679	2.995723	2.995767	2.995811	2.995854	2.995898	2.995942	2.995986	2.996030	44
991	2.996074	2.996117	2.996161	2.996205	2.996249	2.996293	2.996336	2.996380	2.996424	2.996468	44
992	2.996512	2.996555	2.996599	2.996643	2.996687	2.996730	2.996774	2.996818	2.996862	2.996905	44
993	2.996949	2.996993	2.997037	2.997080	2.997124	2.997168	2.997212	2.997255	2.997299	2.997343	44
994	2.997386	2.997430	2.997474	2.997517	2.997561	2.997605	2.997648	2.997692	2.997736	2.997779	44
995	2.997823	2.997867	2.997910	2.997954	2.997998	2.998041	2.998085	2.998128	2.998172	2.998216	44
996	2.998259	2.998303	2.998346	2.998390	2.998434	2.998477	2.998521	2.998564	2.998608	2.998652	44
997	2.998695	2.998736	2.998782	2.998826	2.998869	2.998913	2.998956	2.999000	2.999043	2.999087	44
998	2.999130	2.999174	2.999218	2.999261	2.999305	2.999348	2.999392	2.999435	2.999478	2.999522	44
999	2.999565	2.999609	2.999652	2.999696	2.999739	2.999783	2.999826	2.999870	2.999913	2.999957	43

Min.	0 Degree				
	Sine	Sine Comp.	Tang.	Tang. Com.	
0	0.0000000	10.0000000	0.0000000	Infinite	60
1	6.4637261	9.9999999	6.4637261	13.5362739	59
2	6.7647561	9.9999999	6.7647562	13.2352438	58
3	6.9408473	9.9999998	6.9408475	13.0591525	57
4	7.0657860	9.9999997	7.0657863	12.9342137	56
5	7.1626960	9.9999995	7.1626964	12.8373036	55
6	7.2418771	9.9999993	7.2418778	12.7581222	54
7	7.3088239	9.9999991	7.3088248	12.6911752	53
8	7.3668157	9.9999988	7.3668169	12.6331831	52
9	7.4179681	9.9999985	7.4179696	12.5820304	51
10	7.4637255	9.9999982	7.4637173	12.5362727	50
11	7.5051181	9.9999978	7.5051203	12.4948797	49
12	7.5429065	9.9999974	7.5429091	12.4570909	48
13	7.5776684	9.9999969	7.5776715	12.4223284	47
14	7.6098530	9.9999964	7.6098566	12.3901434	46
15	7.6398160	9.9999959	7.6398201	12.3601799	45
16	7.6678445	9.9999953	7.6678492	12.3321508	44
17	7.6941733	9.9999947	7.6941786	12.3058214	43
18	7.7189966	9.9999940	7.7190026	12.2709974	42
19	7.7424775	9.9999934	7.7424841	12.2575159	41
20	7.7647537	9.9999927	7.7647610	12.2352390	40
21	7.7859427	9.9999919	7.7859508	12.2140492	39
22	7.8061458	9.9999911	7.8061547	12.1938453	38
23	7.8254507	9.9999903	7.8254604	12.1745396	37
24	7.8439338	9.9999894	7.8439444	12.1560556	36
25	7.8616623	9.9999885	7.8616738	12.1383262	35
26	7.8786953	9.9999876	7.8787077	12.1212923	34
27	7.8960854	9.9999866	7.8950988	12.1049012	33
28	7.9108793	9.9999856	7.9108938	12.0891062	32
29	7.9261190	9.9999845	7.9261344	12.0738656	31
30	7.9408419	9.9999835	7.9408584	12.0591416	30
31	7.9550819	9.9999823	7.9550996	12.0449004	29
32	7.9688698	9.9999812	7.9688886	12.0311114	28
33	7.9822334	9.9999800	7.9822534	12.0177466	27
34	7.9951980	9.9999788	7.9952192	12.0047808	26
35	8.0077867	9.9999775	8.0078092	11.9911908	25
36	8.0200207	9.9999762	8.0200445	11.9799555	24
37	8.0319195	9.9999748	8.0319446	11.9680554	23
38	8.0435009	9.9999735	8.0435274	11.9564726	22
39	8.0547814	9.9999721	8.0548094	11.9451906	21
40	8.0657763	9.9999706	8.0658057	11.9341943	20
41	8.0764997	9.9999691	8.0765306	11.9234694	19
42	8.0869646	9.9999676	8.0869970	11.9130030	18
43	8.0971832	9.9999660	8.0972172	11.9027828	17
44	8.1071669	9.9999644	8.1072025	11.8927975	16
45	8.1169262	9.9999628	8.1169634	11.8830366	15
46	8.1264710	9.9999611	8.1265099	11.8734901	14
47	8.1358104	9.9999594	8.1358510	11.8641490	13
48	8.1449532	9.9999577	8.1449956	11.8550044	12
49	8.1539075	9.9999559	8.1539516	11.8460484	11
50	8.1626808	9.9999541	8.1627267	11.8372733	10
51	8.1712804	9.9999522	8.1713282	11.8286718	9
52	8.1797129	9.9999503	8.1797626	11.8202374	8
53	8.1879848	9.9999484	8.1880364	11.8119636	7
54	8.1961020	9.9999464	8.1961556	11.8038444	6
55	8.2040703	9.9999444	8.2041259	11.7958741	5
56	8.2118949	9.9999424	8.2119526	11.7880474	4
57	8.2195811	9.9999403	8.2196408	11.7803592	3
58	8.2271335	9.9999382	8.2271953	11.7728047	2
59	8.2345568	9.9999360	8.2346208	11.7653792	1
60	8.2418553	9.9999338	8.2419215	11.7580785	0
	Sine Comp.	Sine	Tang. Com.	Tang	Min.
	89 Degrees				

Min.	1 Degree				
	Sine	Sine Comp.	Tang.	Tan. Compt.	
0	8.2418553	9.9999338	8.2419215	11.7580785	60
1	8.2490332	9.9999316	8.2491015	11.7508985	59
2	8.2560943	9.9999294	8.2561649	11.7438351	58
3	8.2630424	9.9999271	8.2631153	11.7368847	57
4	8.2698810	9.9999247	8.2699563	11.7300437	56
5	8.2766136	9.9999254	8.2766912	11.7233088	55
6	8.2832434	9.9999200	8.2833234	11.7166766	54
7	8.2897734	9.9999175	8.2898559	11.7101441	53
8	8.2962067	9.9999150	8.2962917	11.7037083	52
9	8.3025460	9.9999125	8.3026335	11.6973665	51
10	8.3087941	9.9999100	8.3088842	11.6911158	50
11	8.3149536	9.9999074	8.3150462	11.6849538	49
12	8.3210269	9.9999047	8.3211221	11.6788779	48
13	8.3270163	9.9999021	8.3271143	11.6728857	47
14	8.3329243	9.9998994	8.3330249	11.6669751	46
15	8.3387529	9.9998966	8.3388563	11.6611437	45
16	8.3445043	9.9998939	8.3446105	11.6553895	44
17	8.3501805	9.9998911	8.3502895	11.6497105	43
18	8.3557835	9.9998882	8.3558953	11.6441047	42
19	8.3613150	9.9998853	8.3614297	11.6385703	41
20	8.3667769	9.9998824	8.3668945	11.6331055	40
21	8.3721710	9.9998794	8.3722915	11.6277085	39
22	8.3774988	9.9998764	8.3776223	11.6223777	38
23	8.3827620	9.9998734	8.3828886	11.6171114	37
24	8.3879622	9.9998703	8.3880918	11.6119082	36
25	8.3931008	9.9998672	8.3932336	11.6067664	35
26	8.3981793	9.9998641	8.3983152	11.6016848	34
27	8.4031990	9.9998609	8.4033381	11.5966619	33
28	8.4081614	9.9998577	8.4083037	11.5916963	32
29	8.4130676	9.9998544	8.4132132	11.5867868	31
30	8.4179190	9.9998512	8.4180679	11.5819321	30
31	8.4227168	9.9998478	8.4228690	11.5771310	29
32	8.4274621	9.9998445	8.4276176	11.5723824	28
33	8.4321561	9.9998411	8.4323150	11.5676850	27
34	8.4367999	9.9998376	8.4369622	11.5630378	26
35	8.4413944	9.9998342	8.4415603	11.5584397	25
36	8.4459409	9.9998306	8.4461103	11.5538897	24
37	8.4504402	9.9998271	8.4506131	11.5493869	23
38	8.4548934	9.9998235	8.4550699	11.5449301	22
39	8.4593013	9.9998199	8.4594814	11.5405186	21
40	8.4636649	9.9998162	8.4638486	11.5361514	20
41	8.4679850	9.9998125	8.4681725	11.5318275	19
42	8.4722626	9.9998088	8.4724538	11.5275462	18
43	8.4764984	9.9998050	8.4766933	11.5233067	17
44	8.4806932	9.9998012	8.4808920	11.5191080	16
45	8.4848479	9.9997974	8.4850505	11.5149495	15
46	8.4889632	9.9997935	8.4891696	11.5108304	14
47	8.4930398	9.9997896	8.4932502	11.5067498	13
48	8.4970784	9.9997856	8.4972928	11.5027072	12
49	8.5010798	9.9997817	8.5012982	11.4987018	11
50	8.5050447	9.9997776	8.5052671	11.4947329	10
51	8.5089736	9.9997736	8.5092001	11,4907999	9
52	8.5128673	9.9997695	8.5130978	11.4869022	8
53	8.5167264	9.9997653	8.5169610	11.4830387	7
54	8.5205514	9.9997612	8.5207902	11.4792098	6
55	8.5243430	9.9997570	8.5245860	11.4754149	5
56	8.5281017	9.9997527	8.5283490	11.4716510	4
57	8.5318281	9.9997484	8.5320797	11.4679203	3
58	8.5355228	9.9997441	8.5357787	11.4642213	2
59	8.5391863	9.9997398	8.5394466	11.4605534	1
60	8.5428192	9.9997354	8.5430838	11.4569162	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	88 Degrees				

Min.	2 Degrees Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.5428192	9.9997354	8.5430838	11.4569162	60
1	8.5464218	9.9997309	8.5466909	11.4533091	59
2	8.5499948	9.9997265	8.5502683	11.4497317	58
3	8.5535386	9.9997220	8.5538166	11.4461834	57
4	8.5570536	9.9997174	8.5573362	11.4426638	56
5	8.5605404	9.9997128	8.5608276	11.4391724	55
6	8.5639994	9.9997082	8.5642912	11.4357088	54
7	8.5674310	9.9997036	8.5677275	11.4322725	53
8	8.5708357	9.9996989	8.5711368	11.4288632	52
9	8.5742139	9.9996942	8.5745197	11.4254803	51
10	8.5775660	9.9996894	8.5778766	11.4221234	50
11	8.5808923	9.9996846	8.5812077	11.4187923	49
12	8.5841933	9.9996798	8.5845136	11.4154864	48
13	8.5874694	9.9996749	8.5877945	11.4122055	47
14	8.5907209	9.9996700	8.5910509	11.4089491	46
15	8.5939483	9.9996650	8.5942832	11.4057168	45
16	8.5971517	9.9996601	8.5974917	11.4025083	44
17	8.6003317	9.9996550	8.6006767	11.3993233	43
18	8.6034886	9.9996500	8.6038386	11.3961614	42
19	8.6066226	9.9996449	8.6069777	11.3930223	41
20	8.6097341	9.9996398	8.6100943	11.3899057	40
21	8.6128235	9.9996346	8.6131889	11.3868111	39
22	8.6158910	9.9996294	8.6162616	11.3837384	38
23	8.6189369	9.9996242	8.6193127	11.3806873	37
24	8.6219616	9.9996189	8.6223427	11.3776573	36
25	8.6249653	9.9996136	8.6253518	11.3746482	35
26	8.6279484	9.9996082	8.6283402	11.3716598	34
27	8.6309111	9.9996028	8.6313083	11.3686917	33
28	8.6338537	9.9995974	8.6342563	11.3657437	32
29	8.6367764	9.9995919	8.6371845	11.3628155	31
30	8.6396796	9.9995865	8.6400931	11.3599059	30
31	8.6425634	9.9995809	8.6429825	11.3570175	29
32	8.6454282	9.9995753	8.6458528	11.3541472	28
33	8.6482742	9.9995697	8.6487044	11.3512946	27
34	8.6511016	9.9995641	8.6515375	11.3484625	26
35	8.6539107	9.9995584	8.6543522	11.3456478	25
36	8.6567017	9.9995527	8.6571490	11.3428510	24
37	8.6594748	9.9995469	8.6599279	11.3400721	23
38	8.6622303	9.9995411	8.6626891	11.3373109	22
39	8.6649684	9.9995353	8.6654331	11.3345669	21
40	8.6676893	9.9995297	8.6681598	11.3318402	20
41	8.6703932	9.9995236	8.6708697	11.3291303	19
42	8.6730804	9.9995176	8.6735628	11.3264372	18
43	8.6757510	9.9995116	8.6762393	11.3237607	17
44	8.6784052	9.9995056	8.6788996	11.3211004	16
45	8.6810433	9.9994996	8.6815437	11.3184563	15
46	8.6836654	9.9994935	8.6841719	11.3158281	14
47	8.6862718	9.9994874	8.6867844	11.3132156	13
48	8.6888625	9.9994812	8.6893813	11.3106187	12
49	8.6914379	9.9994750	8.6919629	11.3080371	11
50	8.6939985	9.9994688	8.6945292	11.3054708	10
51	8.6965431	9.9994625	8.6970806	11.3029194	9
52	8.6990734	9.9994562	8.6996172	11.3003828	8
53	8.7015889	9.9994498	8.7021390	11.2978610	7
54	8.7040899	9.9994435	8.7046465	11.2953535	6
55	8.7065766	9.9994370	8.7071395	11.2928605	5
56	8.7090490	9.9994306	8.7096185	11.2903815	4
57	8.7115075	9.9994241	8.7120384	11.2879166	3
58	8.7139520	9.9994176	8.7145345	11.2854655	2
59	8.7163829	9.9994110	8.7169719	11.2830281	1
60	8.7188002	9.9994044	8.7193958	11.2806042	0
	Sine Comp.	Sine.	Tang. Comp.	Tang.	Min.

87 Degrees

Min.	3 Degrees. Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.7188002	9.9994044	8.7193958	11.2806042	60
1	8.7212040	9.9993978	8.7218063	11.2781937	59
2	8.7235946	9.9993911	8.7242035	11.2757965	58
3	8.7259721	9.9993844	8.7265877	11.2734123	57
4	8.7283366	9.9993776	8.7289589	11.2710411	56
5	8.7306882	9.9993708	8.7313174	11.2686826	55
6	8.7330272	9.9993640	8.7336631	11.2663369	54
7	8.7353535	9.9993572	8.7359964	11.2640036	53
8	8.7376675	9.9993503	8.7383172	11.2616828	52
9	8.7399698	9.9993433	8.7406258	11.2593742	51
10	8.7422586	9.9993364	8.7429222	11.2570778	50
11	8.7445360	9.9993293	8.7452067	11.2547933	49
12	8.7468015	9.9993223	8.7474792	11.2525208	48
13	8.7490553	9.9993152	8.7497400	11.2502600	47
14	8.7512973	9.9993081	8.7519892	11.2480108	46
15	8.7535278	9.9993009	8.7542269	11.2457731	45
16	8.7557469	9.9992938	8.7564531	11.2435469	44
17	8.7579546	9.9992865	8.7586681	11.2413319	43
18	8.7601512	9.9992793	8.7608719	11.2391281	42
19	8.7623366	9.9992720	8.7630647	11.2369353	41
20	8.7645111	9.9992646	8.7652465	11.2347535	40
21	8.7666747	9.9992572	8.7674175	11.2325825	39
22	8.7688275	9.9992498	8.7695777	11.2304223	38
23	8.7709697	9.9992424	8.7717274	11.2282726	37
24	8.7731014	9.9992349	8.7738665	11.2261335	36
25	8.7752226	9.9992274	8.7759952	11.2240048	35
26	8.7773334	9.9992198	8.7781136	11.2218864	34
27	8.7794340	9.9992122	8.7802218	11.2197782	33
28	8.7815244	9.9992046	8.7823199	11.2176801	32
29	8.7836048	9.9991969	8.7844079	11.2155921	31
30	8.7856753	9.9991892	8.7864861	11.2135139	30
31	8.7877359	9.9991815	8.7885544	11.2114456	29
32	8.7897867	9.9991737	8.7906130	11.2093870	28
33	8.7918278	9.9991659	8.7926620	11.2073380	27
34	8.7938594	9.9991580	8.7947014	11.2052986	26
35	8.7958814	9.9991501	8.7967313	11.2032687	25
36	8.7978941	9.9991422	8.7987519	11.2012481	24
37	8.7998974	9.9991342	8.8007632	11.1992368	23
38	8.8018915	9.9991262	8.8027653	11.1972347	22
39	8.8038764	9.9991182	8.8047583	11.1952417	21
40	8.8058523	9.9991101	8.8067422	11.1932578	20
41	8.8078192	9.9991020	8.8087172	11.1912828	19
42	8.8097772	9.9990938	8.8106834	11.1893166	18
43	8.8117264	9.9990856	8.8126407	11.1873593	17
44	8.8136668	9.9990774	8.8145894	11.1854106	16
45	8.8155985	9.9990691	8.8165294	11.1834706	15
46	8.8175217	9.9990608	8.8184608	11 1815392	14
47	8.8194363	9.9990525	8.8203838	11.1796162	13
48	8.8213425	9.9990441	8.8222984	11.1777016	12
49	8.8232404	9.9990357	8.8242046	11.1757954	11
50	8.8251299	9.9990273	8.8261026	11.1738974	10
51	8.8270112	9.9990188	8.8279924	11.1720076	9
52	8.8288844	9.9990103	8.8298741	11.1701259	8
53	8.8307495	9.9990017	8.8317478	11.1682522	7
54	8.8326066	9.9989931	8.8336134	11.1663866	6
55	8.8344557	9.9989845	8.8354712	11.1645288	5
56	8.8362969	9.9989758	8.8373211	11.1626789	4
57	8.8381304	9.9989671	8.8391633	11.1608367	3
58	8.8399561	9.9989584	8.8409977	11.1590023	2
59	8.8417741	9.9989496	8.8428245	11.1571755	1
60	8.8435845	9.9989408	8.8446437	11.1553563	0
	Sine Comp.	Sine.	Tang. Comp.	Tang.	Min.

86 Degrees

Min.	4 Degrees. Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.8435845	9.9989408	8.8446437	11.1553563	60
1	8.8453874	9.9989319	8.8464554	11.1535446	59
2	8.8471827	9.9989230	8.8482597	11.1517403	58
3	8.8489707	9.9989141	8.8500566	11.1499435	57
4	8.8507512	9.9989052	8.8518461	11.1481539	56
5	8.8525245	9.9988962	8.8536283	11.1463717	55
6	8.8542905	9.9988871	8.8554039	11.1445966	54
7	8.8560493	9.9988780	8.8571713	11.1428287	53
8	8.8578010	9.9988689	8.8589321	11.1410679	52
9	8.8595457	9.9988598	8.8606859	11.1393141	51
10	8.8612833	9.9988506	8.8624327	11.1375673	50
11	8.8630139	9.9988414	8.8641725	11.1358275	49
12	8.8647376	9.9988321	8.8659055	11.1340945	48
13	8.8664545	9.9988228	8.8676317	11.1323683	47
14	8.8681646	9.9988135	8.8693511	11.1306489	46
15	8.8698680	9.9988041	8.8710638	11.1289362	45
16	8.8715646	9.9987947	8.8727699	11.1272301	44
17	8.8732546	9.9987853	8.8744694	11.1255306	43
18	8.8749381	9.9987758	8.8761623	11.1238377	42
19	8.8766150	9.9987663	8.8778487	11.1221513	41
20	8.8782854	9.9987567	8.8795286	11.1204714	40
21	8.8799493	9.9987471	8.8812022	11.1187978	39
22	8.8816069	9.9987375	8.8828694	11.1171306	38
23	8.8832581	9.9987278	8.8845303	11.1154697	37
24	8.8849031	9.9987181	8.8861850	11.1138150	36
25	8.8865418	9.9987084	8.8878334	11.1121666	35
26	8.8881743	9.9986986	8.8894757	11.1105243	34
27	8.8898007	9.9986888	8.8911119	11.1088881	33
28	8.8914209	9.9986790	8.8927420	11.1072580	32
29	8.8930351	9.9986691	8.8943660	11.1056340	31
30	8.8946433	9.9986591	8.8959842	11.1040158	30
31	8.8962455	9.9986492	8.8975963	11.1024037	29
32	8.8978418	9.9986392	8.8992026	11.1007974	28
33	8.8994322	9.9986292	8.9008030	11.0991970	27
34	8.9010168	9.9986191	8.9023977	11.0976023	26
35	8.9025955	9.9986090	8.9039866	11.0960134	25
36	8.9041685	9.9985988	8.9055697	11.0944303	24
37	8.9057358	9.9985886	8.9071472	11.0928528	23
38	8.9072975	9.9985784	8.9087190	11.0912810	22
39	8.9088535	9.9985682	8.9102853	11.0897147	21
40	8.9104039	9.9985579	8.9118460	11.0881540	20
41	8.9119487	9.9985475	8.9134012	11.0865988	19
42	8.9134881	9.9985372	8.9149509	11.0850491	18
43	8.9150219	9.9985268	8.9164952	11.0835048	17
44	8.9165504	9.9985163	8.9180340	11.0819660	16
45	8.9180734	9.9985058	8.9195675	11.0804325	15
46	8.9195911	9.9984953	8.9210957	11.0789043	14
47	8.9211034	9.9984848	8.9226186	11.0773814	13
48	8.9226105	9.9984742	8.9241363	11.0758637	12
49	8.9241123	9.9984636	8.9256487	11.0743513	11
50	8.9256089	9.9984529	8.9271560	11.0728440	10
51	8.9271003	9.9984422	8.9286581	11.0713419	9
52	8.9285866	9.9984315	8.9301552	11.0698448	8
53	8.9300678	9.9984207	8.9316471	11.0683529	7
54	8.9315439	9.9984099	8.9331340	11.0668660	6
55	8.9330150	9.9983990	8.9346160	11.0653840	5
56	8.9344811	9.9983881	8.9360929	11.0639071	4
57	8.9359422	9.9983772	8.9375650	11.0624350	3
58	8.9373983	9.9983663	8.9390321	11.0609679	2
59	8.9388496	9.9983553	8.9404944	11.0595056	1
60	8.9402960	9.9983442	8.9419518	11.0580482	0
	Sine Comp.	Sine.	Tang Comp.	Tang.	Min.
	85 Degrees.				

Min.	5 Degrees Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.9402960	9.9983442	8.9419518	11.0580482	60
1	8.9417376	9.9983332	8.9434044	11.0565956	59
2	8.9431743	9.9983220	8.9448523	11.0551477	58
3	8.9446063	9.9983109	8.9462954	11.0537046	57
4	8.9460335	9.9982997	8.9477338	11.0522662	56
5	8.9474561	9.9982885	8.9491676	11.0508324	55
6	8.9488739	9.9982772	8.9505967	11.0494033	54
7	8.9502871	9.9982660	8.9520211	11.0479789	53
8	8.9516957	9.9982546	8.9534410	11.0465590	52
9	8.9530996	9.9982433	8.9548564	11.0451436	51
10	8.9544991	9.9982318	8.9562672	11.0437328	50
11	8.9558940	9.9982204	8.9576735	11.0423265	49
12	8.9572843	9.9982089	8.9590754	11.0409246	48
13	8.9586703	9.9981974	8.9604728	11.0396272	47
14	8.9600517	9.9981859	8.9618659	11.0381341	46
15	8.9614288	9.9981743	8.9632545	11.0367455	45
16	8.9628014	9.9981629	8.9646386	11.0353614	44
17	8.9641697	9.9981510	8.9660188	11.0339812	43
18	8.9655337	9.9981393	8.9673944	11.0326056	42
19	8.9668934	9.9981275	8.9687658	11.0312342	41
20	8.9682487	9.9981158	8.9701330	11.0298670	40
21	8.9695999	9.9981040	8.9714959	11.0285041	39
22	8.9709468	9.9980921	8.9728547	11.0271453	38
23	8.9722895	9.9980802	8.9742092	11.0257908	37
24	8.9736280	9.9980683	8.9755597	11.0244403	36
25	8.9749624	9.9980563	8.9769060	11.0230940	35
26	8.9762926	9.9980443	8.9782483	11.0217517	34
27	8.9776188	9.9980323	8.9795865	11.0204135	33
28	8.9789408	9.9980202	8.9809206	11.0190794	32
29	8.9802589	9.9980081	8.9822507	11.0177493	31
30	8.9815729	9.9979960	8.9835769	11.0164231	30
31	8.9828829	9.9979838	8.9848991	11.0151009	29
32	8.9841889	9.9979716	8.9862173	11.0137827	28
33	8.9854910	9.9979593	8.9875317	11.0124683	27
34	8.9867891	9.9979470	8.9888421	11.0111579	26
35	8.9880834	9.9979347	8.9901487	11.0098513	25
36	8.9893737	9.9979223	8.9914514	11.0085486	24
37	8.9906602	9.9979099	8.9927503	11.0072497	23
38	8.9919429	9.9978975	8.9940454	11.0059546	22
39	8.9932217	9.9978850	8.9953367	11.0046633	21
40	8.9944968	9.9978725	8.9966243	11.0033757	20
41	8.9957681	9.9978599	8.9979081	11.0020919	19
42	8.9970356	9.9978473	8.9991883	11.0008117	18
43	8.9982994	9.9978347	9.0004647	10.9995353	17
44	8.9995595	9.9978220	9.0017375	10.9982625	16
45	9.0008160	9.9978093	9.0030066	10.9969934	15
46	9.0020687	9.9977966	9.0042721	10.9957279	14
47	9.0033179	9.9977838	9.0055340	10.9944660	13
48	9.0045634	9.9977710	9.0067924	10.9932076	12
49	9.0058053	9.9977582	9.0080471	10.9919529	11
50	9.0070436	9.9977453	9.0092984	10.9907016	10
51	9.0082784	9.9977323	9.0105461	10.9894539	9
52	9.0095096	9.9977194	9.0117903	10.9882097	8
53	9.0107374	9.9977064	9.0130310	10.9869690	7
54	9.0119616	9.9976933	9.0142682	10.9857318	6
55	9.0131823	9.9976803	9.0155021	10.9844979	5
56	9.0143996	9.9676672	9.0167325	10.9832675	4
57	9.0156135	9.9976540	9.0179594	10.9820406	3
58	9.0168239	9.9976408	9.0191831	10.9808169	2
59	9.0180309	9.9976276	9.0204033	10.9795967	1
60	9.0192346	9.9976143	9.0216202	10.9783798	0
	Sine Comp.	Sine.	Tang. Comp.	Tang.	Min.
	84 Degrees.				

Min.	6 Degrees				
	Sine	Sine Comp.	Tang.	Tang Com.	
0	9.0192346	9.9976143	9.0216202	10.9783798	60
1	9.0204348	9.9976011	9.0228338	10.9771662	59
2	9.0216318	9.9975877	9.0240441	10.9759559	58
3	9.0228254	9.9975743	9.0252510	10.9747490	57
4	9.0240157	9.9975609	9.0264548	10.9735452	56
5	9.0252027	9.9975475	9.0276552	10.9723448	55
6	9.0263865	9.9975340	9.0288524	10.9711476	54
7	9.0275669	9.9975205	9.0300464	10.9699536	53
8	9.0287442	9.9975069	9.0312373	10.9687627	52
9	9.0299182	9.9974933	9.0324249	10.9675751	51
10	9.0310890	9.9974797	9.0336093	10.9663907	50
11	9.0322567	9.9974660	9.0347906	10.9652094	49
12	9.0334212	9.9974523	9.0359688	10.9640312	48
13	9.0345825	9.9974386	9.0371439	10.9628561	47
14	9.0357407	9.9974248	9.0383159	10.9616841	46
15	9.0368958	9.9974110	9.0394848	10.9605152	45
16	9.0380477	9.9973971	9.0406506	10.9593494	44
17	9.0391966	9.9973833	9.0418134	10.9581866	43
18	9.0403424	9.9973693	9.0429731	10.9570269	42
19	9.0414852	9.9973554	9.0441299	10.9558701	41
20	9.0426249	9.9973414	9.0452836	10.9547164	40
21	9.0437617	9.9973273	9.0464343	10.9535657	39
22	9.0448954	9.9973132	9.0475821	10.9524179	38
23	9.0460261	9.9972991	9.0487270	10.9512730	37
24	9.0471538	9.9972850	9.0498689	10.9501311	36
25	9.0482786	9.9972708	9.0510078	10.9489922	35
26	9.0494005	9.9972566	9.0521439	10.9478561	34
27	9.0505194	9.9972423	9.0532771	10.9467229	33
28	9.0516354	9.9972280	9.0544074	10.9455926	32
29	9.0527485	9.9972137	9.0555349	10.9444651	31
30	9.0538588	9.9971993	9.0566595	10.9433405	30
31	9.0549661	9.9971849	9.0577813	10.9422187	29
32	9.0560706	9.9971704	9.0589002	10.9410998	28
33	9.0571723	9.9971559	9.0600164	10.9399836	27
34	9.0582711	9.9971414	9.0611297	10.9388703	26
35	9.0593671	9.9971268	9.0622403	10.9377597	25
36	9.0604604	9.9971122	9.0633482	10.9366518	24
37	9.0615500	9.9970976	9.0644533	10.9355467	23
38	9.0626386	9.9970829	9.0655556	10.9344444	22
39	9.0637235	9.9970682	9.0666553	10.9333447	21
40	9.0648057	9.9970535	9.0677522	10.9322478	20
41	9.0658852	9.9970387	9.0688465	10.9311535	19
42	9.0669619	9.9970239	9.0699381	10.9300619	18
43	9.0680360	9.9970090	9.0710270	10.9289730	17
44	9.0691074	9.9969941	9.0721133	10.9278867	16
45	9.0701761	9.9969792	9.0731969	10.9268031	15
46	9.0712421	9.9969642	9.0742779	10.9257221	14
47	9.0723055	9.9969492	9.0753563	10.9246437	13
48	9.0733663	9.9969342	9.0764321	10.9235679	12
49	9.0744244	9.9969191	9.0775053	10.9224947	11
50	9.0754799	9.9969040	9.0785760	10.9214240	10
51	9.0765329	9.9968888	9.0796441	10.9203559	9
52	9.0775832	9.9968736	9.0807096	10.9192904	8
53	9.0786310	9.9968584	9.0817726	10.9182274	7
54	9.0796762	9.9968431	9.0828331	10.9171669	6
55	9.0807189	9.9968278	9.0838911	10.9161089	5
56	9.0817590	9.9968125	9.0849466	10.9150534	4
57	9.0827966	9.9967971	9.0859996	10.9140004	3
58	9.0838317	9.9967817	9.0870501	10.9129499	2
59	9.0848643	9.9967662	9.0880981	10.9119019	1
60	9.0858945	9.9967507	9.0891438	10.9108562	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	83 Degrees				

Min.	7 Degrees				
	Sine	Sine Com.	Tang.	Tang. Com.	
0	9.0858945	9.9967507	9.0891438	10.9108562	60
1	9.0869221	9.9967352	9.0901869	10.9098131	59
2	9.0879473	9.9967196	9.0912277	10.9087723	58
3	9.0889700	9.9967040	9.0922660	10.9077340	57
4	9.0899903	9.9966884	9.0933020	10.9066980	56
5	9.0910082	9.9966727	9.0943355	10.9056645	55
6	9.0920237	9.9966570	9.0953667	10.9046333	54
7	9.0930367	9.9966412	9.0963955	10.9036045	53
8	9.0940474	9.9966254	9.0974219	10.9025781	52
9	9.0950556	9.9966096	9.0984460	10.9015540	51
10	9.0960615	9.9965937	9.0994678	10.9005322	50
11	9.0970651	9.9965778	9.1004872	10.8995128	49
12	9.0980662	9.9965619	9.1015044	10.8984956	48
13	9.0990651	9.9965459	9.1025192	10.8974808	47
14	9.1000616	9.9965299	9.1035317	10.8964683	46
15	9.1010558	9.9965138	9.1045410	10.8954580	45
16	9.1020477	9.9964977	9.1055500	10.8944500	44
17	9.1030373	9.9964816	9.1065557	10.8934443	43
18	6.1040246	9.9964655	9.1075591	10.8924409	42
19	9.1050096	9.9964493	9.1085604	10.8914366	41
20	9.1059924	9.9964330	9.1095594	10.8904406	40
21	9.1069729	9.9964167	9.1105562	10.8894438	39
22	9.1079512	9.9964004	9.1115508	10.8884492	38
23	9.1089272	9.9963841	9.1125431	19.8874569	37
24	9.1099010	9.9963677	9.1135333	10.8864667	36
25	9.1108726	9.9963513	9.1145213	10.8854787	35
26	9.1118420	9.9963348	9.1155072	10.8844928	34
27	9.1128092	9.9963183	9.1164909	10.8835091	33
28	9.1137742	9.9963018	9.1174724	10.8825276	33
29	9.1147370	9.9962852	9.1184518	10.8815482	31
30	9.1156977	9.9962686	9 1194291	10.8805709	30
31	9.1166562	9.9962519	9.1204043	10.8795957	29
32	9.1176125	9.9962352	9.1213773	10.8786227	28
33	9.1185667	9.9962185	9.1223482	10.8776518	27
34	9.1195188	9.9962017	9.1233171	10.8766829	26
35	9.1204688	9.9961849	9.1242839	10.8757161	25
36	9.1214167	9.9961681	9.1252486	10.8747514	24
37	9.1223624	9.9961512	9.1262112	10.8737888	23
38	9.1233061	9.9961343	9.1271718	10.8728282	22
39	9.1242477	9.9961174	9.1281303	10.8718697	21
40	9.1251872	9.9961004	9.1290868	10.8709132	20
41	9.1261246	99.960834	9.1300413	10.8699587	19
42	9.1270000	9.9960663	9.1309937	10.8690063	18
43	9.1279934	9.9960492	9.1319442	10.8680558	17
44	9.1289247	9.9660321	9.1328926	10.8671074	16
45	9.1298539	9.9960149	9.1338391	10.8661609	15
46	9.1307812	9.9959977	9.1347835	10.8652165	14
47	9.1317064	9.9959804	9.1357260	10.8642740	13
48	9.1326297	9.9959631	9.1366665	10.8633335	12
49	9.1335509	9.9959458	9.1376051	10.8623949	11
50	9.1344702	9.9959284	9.1385417	10.8614583	10
51	9.1353875	9.9959111	9.1394764	10.8605236	9
52	9.1363028	9.9958936	9.1404092	10.8595908	8
53	9.1372161	9.9958761	9.1413400	10.8586600	7
54	9.1381275	9.9958586	9.1422689	10.8577311	6
55	9.1390370	9.9958411	9.1431959	10.8568041	5
56	9.1399445	9.9958235	9.1441210	10.8558790	4
57	9.1408501	9.9958059	9.1450442	10.8549588	3
58	9.1417537	9.9957882	9.1459655	10.8540345	2
59	9.1426555	9.9957705	9.1468850	10.8531150	1
60	9.1435553	9.9957528	9.1478025	10.8521975	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	85 Degrees				

Min.	8 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.1435553	9.9957528	9.1478025	10.8521975	60
1	9.1444532	9.9957350	9.1487182	10.8512818	59
2	9.1453493	9.9957172	9.1496321	10.8503679	58
3	9.1462435	9.9956993	9.1505441	10.8494559	57
4	9.1471358	9.9956815	9.1514543	10.8485457	56
5	9.1480262	9.9956635	9.1523627	10.8476373	55
6	9.1489148	9.9956456	9.1532692	10.8467308	54
7	9.1498015	9.9956276	9.1541739	10.8458261	53
8	9.1506864	9.9956095	9.1550769	10.8449231	52
9	9.1515694	9.9955915	9.1559780	10.8440220	51
10	9.1524507	9.9955734	9.1568773	10.8431227	50
11	9.1533301	9.9955552	9.1577748	10.8422252	49
12	9.1542076	9.9955370	9.1586706	10.8413294	48
13	9.1550834	9.9955188	9.1595646	10.8404354	47
14	9.1559574	9.9955005	9.1604569	10.8395431	46
15	9.1568296	9.9954822	9.1613473	10.8386527	45
16	9.1577000	9.9954639	9.1622361	10.8377639	44
17	9.1585686	9.9954455	9.1631231	10.8368769	43
18	9.1594354	9.9954271	9.1640083	10.8359917	42
19	9.1603005	9.9954087	9.1648919	10.8351081	41
20	9.1611639	9.9953902	9.1657737	10.8342263	40
21	9.1620254	9.9953717	9.1666538	10.8333462	39
22	9.1628853	9.9953531	9.1675322	10.8324678	38
23	9.1637434	9.9953345	9.1684989	10.8315911	37
24	9.1645998	9.9953159	9.1692839	10.8307161	36
25	9.1654544	9.9952972	9.1701572	10.8298428	35
26	9.1663074	9.9952785	9.1710289	10.8289711	34
27	9.1671586	9.9952597	9.1718989	10.8281011	33
28	9.1680081	9.9952409	9.1727672	10.8272328	32
29	9.1688559	9.9952221	9.1736338	10.8263662	31
30	9.1697021	9.9952033	9.1744988	10.8255012	30
31	9.1705465	9.9951844	9.1753622	10.8246378	29
32	9.1713893	9.9951654	9.1762239	10.8237761	28
33	9.1722305	9.9951464	9.1770840	10.8229260	27
34	9.1730699	9.9951274	9.1779425	10.8220575	26
35	9.1739077	9.9951084	9.1787993	10.8212007	25
36	9.1747439	9.9950893	9.1796546	10.8203454	24
37	9.1755784	9.9950702	9.1805082	10.8194918	23
38	9.1764112	9.9950510	9.1813602	10.8186398	22
39	9.1772425	9.9950318	9.1822106	10.8177894	21
40	9.1780721	9.9950126	9.1830595	10.8169405	20
41	9.1789001	9.9949933	9.1839068	10.8160932	19
42	9.1797265	9.9949740	9.1847525	10.8152475	18
43	9.1805512	9.9949546	9.1855966	10.8144034	17
44	9.1813744	9.9949352	9.1864392	10.8135608	16
45	9.1821960	9.9949158	9.1872802	10.8127198	15
46	9.1830160	9.9948964	9.1881196	10.8118804	14
47	9.1838344	9.9948769	9.1889575	10.8110425	13
48	9.1846512	9.9948573	9.1897939	10.8102061	12
49	9.1854665	9.9948377	9.1906287	10.8093713	11
50	9.1862802	9.9948181	9.1914621	10.8085379	10
51	9.1870923	9.9947985	9.1922939	10.8077061	9
52	9.1879029	9.9947788	9.1931241	10.8068759	8
53	9.1887120	9.9947591	9.1939529	10.8060471	7
54	9.1895195	9.9947393	9.1947802	10.8052198	6
55	9.1903254	9.9947195	9.1956059	10.8043941	5
56	9.1911299	9.9946997	9.1964302	10.8035698	4
57	9.1919328	9.9946798	9.1972530	10.8027470	3
58	9.1927342	9.9946599	9.1980743	10.8019257	2
59	9.1935341	9.9946399	9.1988941	10.8011059	1
60	9.1943324	9.9946199	9.1997125	10.8002875	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	81 Degrees				

Min.	9 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.1943324	9.9946199	9.1997125	10.8002875	60
1	9.1951293	9.9945999	9.2005294	10.7994706	59
2	9.1959247	9.9945798	9.2013449	10.7986551	58
3	9.1967186	9.9945597	9.2021588	10.7978412	57
4	9.1975110	9.9945396	9.2029714	10.7970286	56
5	9.1983019	9.9945194	9.2037825	10.7962175	55
6	9.1999913	9.9944992	9.2045922	10.7954078	54
7	9.1998793	9.9944789	9.2054004	10.7945996	53
8	9.2006658	9.9944587	9.2062072	10.7937928	52
9	9.2014509	9.9944383	9.2070126	10.7929874	51
10	9.2022345	9.9944180	9.2078165	10.7921835	50
11	9.2030167	9.9943975	9.2086191	10.7913809	49
12	9.2037974	9.9943771	9.2094203	10.7905797	48
13	9.2045766	9.9943566	9.2102200	10.7897800	47
14	9.2053545	9.9943361	9.2110184	10.7889816	46
15	9.2061309	9.9943156	9.2118153	10.7881847	45
16	9.2069059	9.9942950	9.2126109	10.7873891	44
17	9.2076795	9.9942743	9.2134051	10.7865949	43
18	9.2084516	9.9942537	9.2141980	10.7858020	42
19	9.2092224	9.9942330	9.2149894	10.7850106	41
20	9.2099917	9.9942122	9.2157795	10.7842205	40
21	9.2107597	9.9941914	9.2165683	10.7834317	39
22	9.2115263	9.9941706	9.2173556	10.7826444	38
23	9.2122914	9.9941498	9.2181417	10.7818583	37
24	9.2130552	9.9941289	9.2189264	10.7810736	36
25	9.2138176	9.9941079	9.2197097	10.7802903	35
26	9.2145787	9.9940870	9.2204917	10.7795083	34
27	9.2153384	9.9940659	9.2212724	10.7787276	33
28	9.2160967	9.9940449	9.2220518	10.7779482	32
29	9.2168536	9.9940238	9.2228298	10.7771702	31
30	9.2176092	9.9940027	9.2236065	10.7763935	30
31	9.2183635	9.9939815	9.2243819	10.7756181	29
32	9.2191164	9.9939603	9.2251561	10.7748439	28
33	9.2198680	9.9939391	9.2259289	10.7740711	27
34	9.2206182	9.9939178	9.2267004	10.7732996	26
35	9.2213671	9.9938965	9.2274706	10.7725294	25
36	9.2221147	9.9938752	9.2282395	10.7717605	24
37	9.2228609	9.9938538	9.2290071	10.7709919	23
38	9.2236059	9.9938324	9.2297735	10.7702265	22
39	9.2243495	9.9938109	9.2305386	10.7694614	21
40	9.2250918	9.9937894	9.2313024	10.7686976	20
41	9.2258328	9.9937679	9.2320650	10.7679350	19
42	9.2265725	9.9937463	9.2328262	10.7671738	18
43	9.2273110	9.9937247	9.2335863	10.7664137	17
44	9.2280481	9.9937030	9.2343451	10.7656549	16
45	9.2287839	9.9936813	9.2351026	10.7648974	15
46	9.2295185	9.9936596	9.2358589	10.7641411	14
47	9.2302518	9.9936378	9.2366139	10.7633861	13
48	9.2309838	9.9936160	9.2373678	10.7626322	12
49	9.2317145	9.9935942	9.2381203	10.7618797	11
50	9.2324440	9.9935723	9.2388717	10.7611283	10
51	9.2331722	9.9935504	9.2396218	10.7603782	9
52	9.2338992	9.9935285	9.2403708	10.7596292	8
53	9.2346249	9.9935065	9.2411185	10.7588815	7
54	9.2353494	9.9934844	9.2418650	10.7581350	6
55	9.2360726	9.9934624	9.2426103	10.7573897	5
56	9.2367946	9.9934403	9.2433543	10.7566457	4
57	9.2375153	9.9934181	9.2440972	10.7559028	3
58	9.2382349	9.9933959	9.2448389	10.7551611	2
59	9.2389532	9.9933737	9.2455794	10.7544206	1
60	9.2396702	9.9933515	9.2463188	10.7536812	0
	Sine Comp.	Sine	Tang. Comp	Tang.	Min.
	80 Degrees				

Min.	10 Degrees				
	Sine	Sine Comp.	Tang.	Tang Com	
0	9.2396702	9.9933515	9.2463188	10.7536812	60
1	9.2403861	9.9933292	9.2470569	10.7539431	59
2	9.2411007	9.9933068	9.2477939	10.7522061	58
3	9.2418141	9.9932845	9.2485297	10.7514703	57
4	9.2425264	9.9932621	9.2492643	10.7507357	56
5	9.2432374	9.9932396	9.2499978	10.7500022	55
6	9.2439472	9.9932171	9.2507301	10.7492699	54
7	9.2446558	9.9931946	9.2514612	10.7485388	53
8	9.2453632	9.9931720	9.2521912	10.7478088	52
9	9.2460695	9.9931494	9.2529200	10.7470800	51
10	9.2467746	9.9931268	9.2536477	10.7463523	50
11	9.2474784	9.9931041	9.2543743	10.7456257	49
12	9.2481811	9.9930814	9.2550997	10.7449003	48
13	9.2488827	9.9930587	9.2558240	10.7441760	47
14	9.2495830	9.9930359	9.2565472	10.7434528	46
15	9.2502822	9.9930131	9.2572692	10.7427308	45
16	9.2509803	9.9929902	9.2579901	10.7420099	44
17	9.2516772	9.9929673	9.2587099	10.7412901	43
18	9.2523729	9.9929444	9.2594285	10.7405715	42
19	9.2530675	9.9929214	9.2601461	10.7398539	41
20	9.2537609	9.9928984	9.2608625	10.7391375	40
21	9.2544532	9.9928753	9.2615779	10.7384221	39
22	9.2551444	9.9928522	9.2622921	10.7377079	38
23	9.2558344	9.9928291	9.2630053	10.7369947	37
24	9.2565233	9.9928059	9.2637173	10.7362827	36
25	9.2572110	9.9927827	9.2644283	10.7355717	35
26	9.2578977	9.9927595	9.2651382	10.7348618	34
27	9.2585832	9.9927362	9.2658470	10.7341530	33
28	9.2592676	9.9927129	9.2665547	10.7334453	32
29	9.2599509	9.9926895	9.2672613	10.7327387	31
30	9.2606330	9.9926661	9.2679669	10.7320331	30
31	9.2613141	9.9926427	9.2686714	10.7313286	29
32	9.2619941	9.9926192	9.2693749	10.7306251	28
33	9.2626729	9.9925957	9.2700772	10.7299228	27
34	9.2633507	9.9925722	9.2707786	10.7292214	26
35	9.2640274	9.9925486	9.2714788	10.7285212	25
36	9.2647030	9.9925250	9.2721780	10.7278220	24
37	9.2653775	9.9925013	9.2728762	10.7271238	23
38	9.2660509	9.9924776	9.2735733	10.7264267	22
39	9.2667232	9.9924539	9.2742694	10.7257306	21
40	9.2673945	9.9924301	9.2749644	10.7250356	20
41	9.2680647	9.9924063	9.2756584	10.7243416	19
42	9.2687338	9.9923824	9.2763514	10.7236486	18
43	9.2694019	9.9923585	9.2770434	10.7229566	17
44	9.2700689	9.9923346	9.2777343	10.7226257	16
45	9.2707348	9.9923106	9.2784242	10.7215758	15
46	9.2713997	9.9922866	9.2791131	10.7208869	14
47	9.2720635	9.9922626	9.2798009	10.7201991	13
48	9.2727263	9.9922385	9.2804878	10.7195122	12
49	9.2733880	9.9922144	9.2811736	10.7188264	11
50	9.2740487	9.9921902	9.2818585	10.7181415	10
51	9.2747083	9.9921660	9.2825423	10.7174577	9
52	9.2753669	9.9921418	9.2832251	10.7167749	8
53	9.2760245	9.9921175	9.2839070	10.7160930	7
54	9.2766811	9.9920932	9.2845878	10.7154122	6
55	9.2773366	9.9920689	9.2852677	10.7147323	5
56	9.2779911	9.9920455	9.2859466	10.7140534	4
57	9.2786445	9.9920201	9.2866245	10.7133755	3
58	9.2792970	9.9919956	9.2873014	10.7126986	2
59	9.2799484	9.9919711	9.2879773	10.7120227	1
60	9.2805988	9.9919466	9.2886523	10.7113477	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	79 Degrees				

Min.	11 Degrees				
	Sine	Sine Com.	Tang.	Tang. Com.	
0	9.2805988	9.9919466	9.2886523	10.7113477	60
1	9.2812483	9.9919220	9.2893263	10.7106737	59
2	9.2818967	9.9918974	9.2899993	10.7100007	58
3	9.2825441	9.9918727	9.2906713	10.7093287	57
4	9.2831905	9.9918480	9.2913424	10.7086576	56
5	9.2838359	9.9618233	9.2920126	10.7079874	55
6	9.2844803	9.9917985	9.2926817	10.7073183	54
7	9.2851237	9.9917737	9.2933500	10.7066500	53
8	9.2857661	9.9917489	9.2940172	10.7059828	52
9	9.2864076	9.9917240	9.2946836	10 7053164	51
10	9.2870480	9.9916991	9.2953489	10.7046511	50
11	9.2876875	9.9916741	9.2960134	10.7039866	49
12	9.2883260	9.9916492	9.2966769	10.7033231	48
13	9.2889636	9.9916241	9.2973395	10.7026605	47
14	9.2896001	9.9915990	9.2980011	10.7019989	46
15	9.2902357	9.9915739	9.2986618	10.7013382	45
16	9.2908704	9.9915488	9.2993216	10.7006784	44
17	9.2915040	9.9915236	9.2999804	10.7000196	43
18	9.2921367	9.9914984	9.3006383	10.6993617	42
19	9.2927685	9.9914731	9.3012954	10.6987046	41
20	9.2933993	9.9914478	9.3019514	10.6980486	40
21	9.2940291	9.9914225	9.3026066	10.6973934	39
22	9.2946580	9.9913917	9.3032609	10.6967391	38
23	9.2952859	9.9913717	9.3039143	10.6960857	37
24	9.2959129	9.9913462	9.3045667	10.6954333	36
25	9.2965390	9.9913207	9.3052183	10.6947817	35
26	9.2971641	9.9912952	9.3058689	10.6941311	34
27	9.2977883	9.9912696	9.3065187	10.6934813	33
28	9.2984116	9.9912440	9.3071675	10.6928325	32
29	9.2990339	9.9912184	9.3078155	10.6921845	31
30	9.2996553	9.9911927	9.3084626	10.6915374	30
31	9.3002758	9.9911670	9.3091088	10.6908912	29
32	9.3008953	9.9911412	9.3097541	10.6902459	28
33	9.3015140	9.9911154	9.3103985	10.6896015	27
34	9.3021317	9.9910896	9.3110421	10.6889579	26
35	9.3027485	9.9910637	9.3116848	10.6883152	25
36	9.3033644	9.9910378	9.3123266	10.6876734	24
37	9.3039794	9.9910119	9.3129675	10.6870325	23
38	9.3045934	9.9909859	9.3136076	10.6863924	22
39	9.3052066	9.9909598	9.3142468	10.6857532	21
40	9.3058189	9.9909338	9.3148851	10.6851149	20
41	9.3064303	9.9909077	9.3155226	10.6844774	19
42	9.3070407	9.9908815	9.3161592	10.6838408	18
43	9.3076503	9.9908553	9.3167950	10.6832050	17
44	9.3082590	9.9908291	9.3174299	10.6825701	16
45	9.3088668	9.9908029	9.3180640	10.6819360	15
46	9.3094737	9.9907766	9.3186972	10.6813028	14
47	9.3100798	9.9907502	9.3193295	10.6806705	13
48	9.3106849	9.9907239	9.3199611	10.6800389	12
49	9.3112892	9.9906974	9.3205918	10.6794082	11
50	9.3118926	9.9906710	9.3212216	10.6787784	10
51	9.3124951	9.9906445	9.3218506	10.6781494	9
52	9.3130968	9.9906180	9.3224788	10.6775212	8
53	9.3136976	9.9905914	9.3231061	10.6768939	7
54	9.3142975	9.9905648	9.3237327	10.6762673	6
55	9.3148965	9.9905382	9.3243584	10,6759416	5
56	9.3154947	9.9905115	9.3249832	10.6750168	4
57	9.3160921	9.9904848	9.3256073	10.6734927	3
58	9.3166885	9.9904580	9.3262305	10.6737695	2
59	9.3172842	9.9904312	9.3268529	10.6731471	1
60	9.3178789	9.9904044	9.3274745	10.6725255	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	78 Degrees				

Min.	12 Degrees Sine	Sine Comp.	Tang.	Tang. Com.	
0	9.3178789	9.9904044	9.3274745	10.6725255	60
1	9.3184728	9.9903775	9.3280953	10.6719047	59
2	9.3190659	9.9903506	9.3287153	10.6712847	58
3	9.3196581	9.9903237	9.3293345	10.6706655	57
4	9.3202495	9.9902967	9.3299528	10.6700472	56
5	9.3208400	9.9902697	9.3305704	10.6694996	55
6	9.3214297	9.9902426	9.3311872	10.6688128	54
7	9.3220186	9.9902155	9.3318031	10.6681969	53
8	9.3226066	9.9901883	9.3324183	10.6675817	52
9	9.3231938	9.9901612	9.3330327	10.6669673	51
10	9.3237802	9.9901339	9.3336463	10.6663537	50
11	9.3243657	9.9901067	9.3342591	10.6657409	49
12	9.3249505	9.9900794	9.3348711	10.6651289	48
13	9.3255344	9.9900521	9.3354823	10.6645177	47
14	9.3261174	9.9900247	9.3360927	10.6639073	46
15	9.3266997	9.9899973	9.3367024	10.6632976	45
16	9.3272811	9.9899698	9.3373113	10.6626887	44
17	9.3278617	9.9899423	9.3379194	10.6620806	43
18	9.3284416	9.9899148	9.3385267	10.6614733	42
19	9.3290206	9.9898873	9.3391333	10.6608667	41
20	9.3295988	9.9898597	9.3397391	10.6602609	40
21	9.3301761	9.9898320	9.3403441	10.6596559	39
22	9.3307527	9.9898043	9.3409484	10.6590516	38
23	9.3313285	9.9897766	9.3415519	10.6584481	37
24	9.3319035	9.9897489	9.3421546	10.6578454	36
25	9.3324777	9.9897211	9.3427566	10.6572434	35
26	9.3330511	9.9896932	9.3433578	10.6566422	34
27	9.3336237	9.9896654	9.3439583	10.6560417	33
28	9.3341955	9.9896374	9.3445580	10.6554420	32
29	9.3347665	9.9896095	9.3451570	10.6548430	31
30	9.3353368	9.9895815	9.3457552	10.6542448	30
31	9.3359062	9.9895535	9.3463527	10.6536473	29
32	9.3364749	9.9895254	9.3469494	10.6530506	28
33	9.3370428	9.9894973	9.3475454	10.6524546	27
34	9.3376099	9.9894692	9.3481407	10.6518593	26
35	9.3381762	9.9894410	9.3487352	10.6512648	25
36	9.3387418	9.9894128	9.3493290	10.6506710	24
37	9.3393065	9.9893845	9.3499220	10.6500780	23
38	9.3398706	9.9893562	9.3505143	10.6494857	22
39	9.3404338	9.9893279	9.3511059	10.6488941	21
40	9.3409963	9.9892995	9.3516968	10.6483032	20
41	9.3415580	9.9892711	9.3522869	10.6477131	19
42	9.3421190	9.9892427	9.3528763	10.6471237	18
43	9.3426792	9.9892142	9.3534650	10.6465350	17
44	9.3432386	9.9891856	9.3540530	10.6459470	16
45	9.3437973	9.9891571	9.3546402	10.6453598	15
46	9.3443552	9.9891285	9.3552267	10.6447733	14
47	9.3449124	9.9890998	9.3558126	10.6441874	13
48	9.3454688	9.9890711	9.3563977	10.6436023	12
49	9.3460245	9.9890424	9.3569821	10.6430179	11
50	9.3465794	9.9890137	9.3575658	10.6424342	10
51	9.3471336	9.9889849	9.3581487	10.6418513	9
52	9.3476870	9.9889560	9.3587310	10.6412690	8
53	9.3482397	9.9889271	9.3593126	10.6406874	7
54	9.3487917	9.9888982	9.3598935	10.6401065	6
55	9.3493429	9.9888693	9.3604736	10.6395264	5
56	9.3498934	9.9888403	9.3610531	10.6389469	4
57	9.3504432	9.9888113	9.3616319	10.6383681	3
58	9.3509922	9.9887822	9.3622100	10.6377900	2
59	9.3515405	9.9887531	9.3627874	10.6372126	1
60	9.3520880	9.9887239	9.3633641	10.6366359	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	77 Degrees				

Min.	13 Degrees Sine	Sine Comp.	Tang	Tang. Comp.	
0	9.3520880	9.9887239	9.3633641	10.6366359	60
1	9.3526349	9.8886947	9.3639401	10.6360599	59
2	9.3531810	9.9886655	9.3645155	10.6354845	58
3	9.3537264	9.9886363	9.3650901	10.6349099	57
4	9.3542710	9.9886070	9.3656641	10.6343359	56
5	9.3548150	9.9885776	9.3662374	10.6337626	55
6	9.3553582	9.9885482	9.3668100	10.6331900	54
7	9.3559007	9.9885188	9.3673819	10.6326181	53
8	9.3564426	9.9884894	9.3679532	10.6320468	52
9	9.3569836	9.9884599	9.3685238	10.6314762	51
10	9.3575240	9.9884303	9.3690937	10.6309063	50
11	9.3580637	9.9884008	9.3696629	10.6303371	49
12	9.3586027	9.9883712	9.3702315	10.6297685	48
13	9.3591409	9.9883415	9.3707994	10.6292006	47
14	9.3596785	9.9883118	9.3713667	10.6286333	46
15	9.3602154	9.9882821	9.3719333	10.6280667	45
16	9.3607515	9.9882523	9.3724992	10.6275008	44
17	9.3612870	9.9882225	9.3730645	10.6269355	43
18	9.3618217	9.9881927	9.3736291	10.6263709	42
19	9.3623558	9.9881628	9.3741930	10.6258070	41
20	9.3628892	9.9881329	9.3747563	10.6252437	40
21	9.3634219	9.9881029	9.3753190	10.6246810	39
22	9.3639539	9.9880729	9.3758810	10.6241190	38
23	9.3644852	9.9880429	9.3764423	10.6235577	37
24	9.3650158	9.9880128	9.3770030	10.6229970	36
25	9.3655458	9.9874827	9.3775631	10.6224369	35
26	9.3660750	9.9879525	9.3781225	10.6218775	34
27	9.3666036	9.9879223	9.3786813	10.6213187	33
28	9.3671315	9.9878921	9.3792394	10.6207606	32
29	9.3676587	9.9878618	9.3797969	10.6202031	31
30	9.3681853	9.9878315	9.3803537	10.6196463	30
31	9.3687111	9.9878012	9.3809100	10.6190900	29
32	9.3692363	9.9877708	9.3814655	10.6185345	28
33	9.3697608	9.9877404	9.3820205	10.6179795	27
34	9.3702847	9.9877099	9.3825748	10.6174252	26
35	9.3708079	9.9876794	9.3831285	10.6168715	25
36	9.3713304	9.9876488	9.3836816	10.6163184	24
37	9.3718523	9.9876183	9.3842340	10.6157660	23
38	9.3723735	9.9875876	9.3847858	10.6152142	22
39	9.3728940	9.9875570	9.3853370	10.6146630	21
40	9.3734139	9.9875263	9.3858876	10.6141124	20
41	9.3739331	9.9874955	9.3864376	10.6135624	19
42	9.3744517	9.9874648	9.3869869	10.6130131	18
43	9.3749696	9.9874339	9.3875356	10.6124664	17
44	9.3754868	9.9874631	9.3880837	10.6119163	16
45	9.3760034	9.9873722	9.3886312	10.6115688	15
46	9.3765194	9.9873413	9.3891781	10.6108219	14
47	9.3770347	9.9873103	9.3897244	10.6102756	13
48	9.3775493	9.9872793	9.3902700	10.6097300	12
49	9.3780633	9.9872482	9.3908151	10.6091849	11
50	9.3785767	9.9872171	9.3913595	10.6086405	10
51	9.3790894	9.9871860	9.3919034	10.6080966	9
52	9.3796015	9.9871549	9.3924466	10.6075534	8
53	6.3801129	9.9871236	9.3929893	10.6070107	7
54	9.3806237	9.9870924	9.3935313	10.6064687	6
55	9.3811339	9.9870611	9.3940727	10.6059273	5
56	9.3816434	9.9870298	9.3946136	10.6053864	4
57	9.3821523	9.9869984	9.3951538	10.6048462	3
58	9.3826605	9.9869670	9.3956935	10.6043065	2
59	9.3831682	9.9869356	9.3962326	10.6037674	1
60	9.3836752	9.9869041	9.3967711	10.6032289	0
	Sine Comp	Sine	Tang. Com.	Tang.	Min.
	76 Degrees				

Min.	14 Degrees Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.3836752	9.9869041	9.3967711	10.6032289	60
1	9.3841815	9.9868726	9.3973089	10.6026911	59
2	9.3846873	9.9868410	9.3978463	10.6021537	58
3	9.3851924	9.9868094	9.3983830	10.6016170	57
4	9.3856969	9.9867778	9.3989191	10.6010809	56
5	9.3862008	9.9867461	9.3994547	10.6005453	55
6	9.3867040	9.9867144	9.3999896	10.6000104	54
7	9.3872067	9.9866827	9.4005240	10.5994760	53
8	9.3877087	9.9866509	9.4010578	10.5989422	52
9	9.3882101	9.9866191	9.4015910	10.5984090	51
10	9.3887109	9.9865872	9.4021237	10.5978763	50
11	9.3892111	9.6865553	9.4026558	10.5973442	49
12	9.3897106	9.9865233	9.4031873	10.5968127	48
13	9.3902096	9.9864913	9.4037182	10.5962818	47
14	9.3907079	9.9864593	9.4042486	10.5957514	46
15	9.3912057	9.9864273	9.4047784	10.5952216	45
16	9.3917028	9.9863952	9.4053076	10.5946924	44
17	9.3921993	9.9863630	9.4058363	10.5941637	43
18	9.3926952	9.9863308	9.4063644	10.5936356	42
19	9.3931905	9.9862986	9.4068919	10.5931081	41
20	9.3936852	9.9862663	9.4074189	10.5925811	40
21	9.3941794	9.9862340	9.4079453	10.5920547	39
22	9.3946729	9.9862017	9.4084712	10.5915288	38
23	9.3951658	9.9861693	9.4089965	10.5910035	37
24	9.3956581	9.9861369	9.4095212	10.5904788	36
25	9.3961499	9.9861045	9.4100454	10.5899546	35
26	9.3966410	9.9860720	9.4105690	10.5894310	34
27	9.3971315	9.9860394	9.4110921	10.5889079	33
28	9.3976215	9.9860069	9.4116146	10.5883854	32
29	9.3981109	9.9859742	9.4121366	10.5878634	31
30	9.3985996	9.9859416	9.4126581	10.5873419	30
31	9.3990878	9.9859089	9.4131789	10.5868211	29
32	9.3995754	9.9858762	9.4136993	10.5863007	28
33	9.4000625	9.9858434	9.4142191	10.5857809	27
34	9.4005489	9.9858106	9.4147383	10.5852617	26
35	9.4010348	9.9857777	9.4152570	10.5847430	25
36	9.4015201	9.9857449	9.4157752	10.5842248	24
37	9.4020048	9.9857119	9.4162928	10.5837072	23
38	9.4024889	9.9856790	9.4168099	10.5831901	22
39	9.4029734	9.9856460	9.4173265	10.5826735	21
40	9.4034554	9.9856129	9.4178425	10.5821575	20
41	9.4039378	9.9855798	9.4183580	10.5816420	19
42	9.4044196	9.9855467	9.4188729	10.5811271	18
43	9.4049009	9.9855135	9.4193874	10.5806126	17
44	9.4053816	9.9854803	9.4199013	10.5800987	16
45	9.4058617	9.9854471	9.4204146	10.5795854	15
46	9.4003413	9.9854138	9.4209275	10.5790725	14
47	9.4068203	9.9853805	9.4214398	10.5785602	13
48	9.4072987	9.9853471	9.4219515	10.5780485	12
49	9.4077766	9.9853138	9.4224628	10.5775372	11
50	9.4082539	9.9852803	9.4229735	10.5770265	10
51	9.4087306	9.9852468	9.4234838	10.5765162	9
52	9.4092068	9.9852133	9.4239935	10.5760065	8
53	9.4096824	9.9851798	9.4245026	10.5754974	7
54	9.4101575	9.9851462	9.4250113	10.5749887	6
55	9.4106320	9.9851125	9.4255194	10.5744806	5
56	9.4111059	9.9850789	9.4260271	10.5739729	4
57	9.4115793	9.9850452	9.4265342	10.5734658	3
58	9.4120522	9.9850114	9.4270408	10.5729592	2
59	9.4125245	9.9849776	9.4275469	10.5724531	1
60	9.4129962	9.9849438	9.4280525	10.5719475	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	75 Degrees				

Min.	15 Degrees Sine	Sine Comp.	Tang.	Tang Comp.	
0	9.4129962	9.9849438	9.4280525	10.5719475	60
1	9.4134674	9.9849099	9.4285575	10.5714425	59
2	9.4139381	9.9848760	9.4290621	10.5709379	58
3	9.4144082	9.9848420	9.4295661	10.5704339	57
4	9.4148778	9.9848081	9.4300697	10.5699303	56
5	9.4153468	9.9847740	9.4305727	10.5694273	55
6	9.4158152	9.9847400	9.4310753	10.5689247	54
7	9.4162832	9.9847059	9.4315773	10.5684127	53
8	9.4165506	9.9846717	9.4320789	10.5679211	52
9	9.4172174	9.9846375	9.4325799	10.5674201	51
10	9.4176837	9.9846033	9.4330804	10.5669196	50
11	9.4181495	9.9845690	9.4335805	10.5664195	49
12	9.4186148	9.9845347	9.4340800	10.5659200	48
13	9.4190795	9.9845004	9.4345791	10.5654209	47
14	9.4195436	9.9844660	9.4350776	10.5649224	46
15	9.4200073	9.9844316	9.4355757	10.5644243	45
16	9.4204704	9.9843971	9.4360733	10.5639267	44
17	9.4209330	9.9843626	9.4365704	10.5634296	43
18	9.4213950	9.9843281	9.4370670	10.5629330	42
19	9.4218566	9.9842935	9.4375631	10.5624369	41
20	9.4223176	9.9842589	9.4380587	10.5619413	40
21	9.4227780	9.9842242	9.4385538	10.5614462	39
22	9.4232380	9.9841895	9.4390485	10.5609515	38
23	9.4236974	9.9841548	9.4395426	10.5604574	37
24	9.4241563	9.9841200	9.4400363	10.5599637	36
25	9.4246147	9.9840852	9.4405295	10.5594705	35
26	9.4250726	9.9840503	9.4410222	10.5589778	34
27	9.4255299	9.9840154	9.4415145	10.5584855	33
28	9.4259867	9.9839805	9.4420062	10.5579938	32
29	9.4264430	9.9839455	9.4424975	10.5575025	31
30	9.4268988	9.9839105	9.4429883	10.5570117	30
31	9.4273541	9.9838755	9.4434786	10.5565214	29
32	9.4278089	9.9838404	9.4439685	10.5560315	28
33	9.4282631	9.9838052	9.4444579	10.5555421	27
34	9.4287169	9.9837701	9.4449468	10.5550532	26
35	9.4291701	9.9837348	9.4454352	10.5545648	25
36	9.4296228	9.9836996	9.4459232	10.5540768	24
37	9.4300750	9.9836643	9.4464107	10.5535893	23
38	9.4305267	9.9836290	9.4468978	10.5531022	22
39	9.4309779	9.9835936	9.4473843	10.5526157	21
40	9.4314286	9.9835582	9.4478704	10.5521296	20
41	9.4318788	9.9835227	9.4483561	10.5516439	19
42	9.4323285	9.9834872	9.4488413	10.5511587	18
43	9.4327777	9.9834517	9.4493260	10.5506740	17
44	9.4332264	9.9834161	9.4498102	10.5501898	16
45	9.4336746	9.9833805	9.4502940	10.5497060	15
46	9.4341223	9.9833449	9.4507774	10.5492220	14
47	9.4345694	9.9833094	9.4512602	10.5487398	13
48	9.4350161	9.9833735	9.4517427	10.5482573	12
49	9.4354623	9.9832377	9.4522246	10.5477754	11
50	9.4359080	9.9832019	9.4527061	10.5472939	10
51	9.4363532	9.9831661	9.4531872	10.5468128	9
52	9.4367980	9.9831302	9.4536678	10.5463522	8
53	9.4372422	9.9830942	9.4541479	10.5458521	7
54	9.4376859	9.9830583	9.4546276	10.5453724	6
55	9.4381292	9.9830223	9.4551069	10.5448931	5
56	9.4385719	9.9829862	9.4555857	10.5444143	4
57	9.4390142	9.9829501	9.4560641	10.5439359	3
58	9.4394560	9.9829140	9.4565420	10.5434580	2
59	9.4398973	9.9828778	9.4570194	10.5429806	1
60	9.4403381	9.9828416	9.4574964	10.5425036	0
	Sine Comp.	Sine	Tang. Comp	Tang.	Min.
	74 Degrees				

Min.	16 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4403381	9.9828416	9.4574964	10.5425036	60
1	9.4407784	9.9828054	9.4579370	10.5420270	59
2	9.4412182	9.9827691	9.4584491	10.5415509	58
3	9.4416576	9.9827328	9.4589248	10.5410752	57
4	9.4420965	9.9826964	9.4594001	10.5405999	56
5	9.4425349	9.9826600	9.4598749	10.5401251	55
6	9.4429728	9.9826236	9.4603492	10.5396508	54
7	9.4434103	9.9825871	9.4608232	10.5391768	53
8	9.4438472	9.9825506	9.4612967	10.5387033	52
9	9.4442837	9.9825140	9.4617697	10.5382303	51
10	9.4447197	9.9824774	9.4622423	10.5377577	50
11	9.4451553	9.9824408	9.4627145	10.5372855	49
12	9.4455904	9.9824041	9.4631863	10.5368137	48
13	9.4460250	9.9823674	9.4636576	10.5363424	47
14	9.4464591	9.9823306	9.4641285	10.5358715	46
15	9.4468927	9.9822938	9.4645990	10.5354010	45
16	9.4473259	9.9822569	9.4650690	10.5349310	44
17	9.4477586	9.9822201	9.4655386	10.5344614	43
18	9.4481909	9.9821831	9.4660078	10.5339922	42
19	9.4486227	9.9821462	9.4664765	10.5335235	41
20	9.4490540	9.9821092	9.4669448	10.5330552	40
21	9.4494849	9.9820721	9.4674127	10.5325873	39
22	9.4499153	9.9820351	9.4678802	10.5321198	38
23	9.4503452	9.9819979	9.4683473	10.5316527	37
24	9.4507747	9.9819608	9.4688139	10.5311861	36
25	9.4512037	9.9819236	9.4692801	10.5307199	35
26	9.4516322	9.9818863	9.4697459	10.5302541	34
27	9.4520603	9.9818490	9.4702112	10.5297888	33
28	9.4524879	9.9818117	9.4706762	10.5293238	32
29	9.4529151	9.9817744	9.4711407	10.5288593	31
30	9.4533418	9.9817370	9.4716048	10.5283951	30
31	9.4537681	9.9816995	9.4720685	10.5279315	29
32	9.4541939	9.9816620	9.4725318	10.5274682	28
33	9.4546192	9.9816245	9.4729947	10.5270053	27
34	9.4550441	9.9815870	9.4734571	10.5265429	26
35	9.4554686	9.9815494	9.4739192	10.5260808	25
36	9.4558926	9.9815117	9.4743808	10.5256192	24
37	9.4563161	9.9814740	9.4748421	10.5251579	23
38	9.4567392	9.9814363	9.4753029	10.5246971	22
39	9.4571618	9.9813986	9.4757633	10.5242367	21
40	9.4575840	9.9813608	9.4762233	10.5237767	20
41	9.4580058	9.9813229	9.4766829	10.5233171	19
42	9.4584271	9.9812850	9.4771421	10.5228579	18
43	9.4588480	9.9812471	9.4776009	10.5223991	17
44	9.4592684	9.9812091	9.4780592	10.5219408	16
45	9.4596884	9.9811711	9.4785172	10.5214828	15
46	9.4601079	9.9811331	9.4789748	10.5210252	14
47	9.4605270	9.9810950	9.4794319	10.5205681	13
48	9.4609456	9.9810569	9.4798887	10.5201113	12
49	9.4613638	9.9810187	9.4803451	10.5196549	11
50	9.4617816	9.9809805	9.4808011	10.5191989	10
51	9.4621989	9.9809423	9.4812566	10.5187434	9
52	9.4626158	9.9809040	9.4817118	10.5182882	8
53	9.4630323	9.9808657	9.4821666	10.5178334	7
54	9.4634483	9.9808273	9.4826210	10.5173790	6
55	9.4638639	9.9807889	9.4830750	10.5169250	5
56	9.4642790	9.9807505	9.4835286	10.5164714	4
57	9.4676938	9.9807120	9.4839818	10.5160182	3
58	9.4651081	9.9806735	9.4844346	10.5155654	2
59	9.4655219	9.9806349	9.4848870	10.5151130	1
60	9.4659353	9.9805963	9.4853390	10.5146610	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	73 Degrees				

Min.	17 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4659353	9.9805963	9.4853390	10.5146610	60
1	9.4663483	9.9805577	9.4857907	10.5143093	59
2	9.4667609	9.9805190	9.4862419	10.5137581	58
3	9.4671730	9.9804803	9.4866928	10.5133072	57
4	9.4675848	9.9804415	9.4871433	10.5128567	56
5	9.4679960	9.9804027	9.4875933	10.5124067	55
6	9.4684069	9.9803639	9.4880430	10.5119570	54
7	9.4688173	9.9803250	9.4884924	10.5115076	53
8	9.4692273	9.9802860	9.4889413	10.5110587	52
9	9.4696369	9.9802471	9.4893898	10.5106102	51
10	9.4700461	9.9802081	9.4898380	10.5101620	50
11	9.4704548	9.9801690	9.4902858	10.5097142	49
12	9.4708631	9.9801299	9.4907332	10.5092668	48
13	9.4712710	9.9800908	9.4911802	10.5088198	47
14	9.4716785	9.9800516	9.4916269	10.5083731	46
15	9.4720856	9.9800124	9.4920731	10.5079269	45
16	9.4724922	9.9799732	9.4925190	10.5074810	44
17	9.4728985	9.9799339	9.4929646	10.5070354	43
18	9.4733043	9.9798946	9.4934097	10.5065903	42
19	9.9737097	9.9798552	9.4938545	10.5061455	41
20	9.4741146	9.9798158	9.4942988	10.5057012	40
21	9.4745192	9.9797764	9.4947429	10.5052571	39
22	9.4749234	9.9797369	9.4951865	10.5048135	38
23	9.4753271	9.9796793	9.4956298	10.5043702	37
24	9.4757304	9.9796578	9.4960727	10.5039273	36
25	9.4761334	9.9796182	9.4965152	10.5034848	35
26	9.4765359	9.9795785	9.4969574	10.5030426	34
27	9.4769380	9.9795388	9.4973991	10.5026009	33
28	9.4773396	9.9794991	9.4978406	10.5021594	32
29	9.4777409	9.9799593	9.4982816	10.5017184	31
30	9.4781418	9.9794195	9.4987223	10.5012777	30
31	9.4785423	9.9793796	9.4991626	10.5008374	29
32	9.4789423	9.9793398	9.4996026	10.5003974	28
33	9.4793420	9.9792998	9.5000422	10.4999578	27
34	9.4797412	9.9792599	9.5004814	10.4995136	26
35	9.4801401	9.9792198	9.5009203	10.4990797	25
36	9.4805385	9.9791798	9.5013588	10.4986412	24
37	9.4809366	9.9791397	9.5017969	10.4982031	23
38	9.4813342	9.9790996	9.5022347	10.4977653	22
39	9.4817315	9.9790594	9.5026721	10.4973279	21
40	9.4821283	9.9790191	9.5031092	10.4968908	20
41	9.4825248	9.9789789	9.5035459	10.4964541	19
42	9.4829208	9.9789386	9.5039822	10.4960178	18
43	9.4833165	9.9788983	9.5044182	10.4955818	17
44	9.4837117	9.9788579	9.5048538	10.4951462	16
45	9.4841066	9.9788175	9.5052891	10.4947109	15
46	9.4845010	9.9787770	9.5057240	10.4942760	14
47	9.4848951	9.9787365	9.5061586	10.4938414	13
48	9.4852888	9.9786960	9.5065928	10.4934072	12
49	9.4856820	9.9786554	9.5070267	10.4929733	11
50	9.4860749	9.9786148	9.5074602	10.4925398	10
51	9.4864674	9.9785741	9.5078933	10.4921067	9
52	9.4868595	9.9785334	9.5083261	10.4916739	8
53	9.4872512	9.9784927	9.5087586	10.4912414	7
54	9.4876426	9.9784519	9.5091907	10.4908093	6
55	9.4880335	9.6784111	9.5096224	10.4903776	5
56	9.4884240	9.9783702	9.5100539	10.4899461	4
57	9.4888142	9.9783293	9.5104849	10.4895151	3
58	9.4892040	9.9782883	9.5109156	10.4890844	2
59	9.4895934	9.9782474	9.5113460	10.4886540	1
60	9.4899824	9.9782063	9.5117760	10.4882240	0
	Sine Comp.	Sine	Tang Comp.	Tang.	Min.
	72 Degrees				

Min.	18 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4899824	9.9782062	9.5117760	10.4882240	60
1	9.4903710	9.9781653	9.5122057	10.4877943	59
2	9.4907592	9.9781241	9.5126351	10.4873649	58
3	9.4911471	9.9780830	9.5130641	10.4869359	57
4	9.4915345	9.9780418	9.5134927	10.4865073	56
5	9.4919216	9.9780006	9.5139210	10.4860790	55
6	9.4923083	9.9779593	9.5143490	10.4856510	54
7	9.4926946	9.9779180	9.5147766	10.4852234	53
8	9.4930806	9.9778766	9.5152039	10.4847961	52
9	9.4934661	9.9778353	9.5156309	10.4843691	51
10	9.4938513	9.9777938	9.5160575	10.4839425	50
11	9.4942361	9.9777523	9.5164838	10.4835162	49
12	9.4946205	9.9777108	9.5169097	10.4830903	48
13	9.4950046	9.9776693	9.5173353	10.4826647	47
14	9.4953883	9.9776277	9.5177606	10.4822394	46
15	9.4957716	9.9775860	9.5181855	10.4818145	45
16	9.4961545	9.9775444	9.5186101	10.4813899	44
17	9.4965370	9.9775026	9.5190344	10.4809656	43
18	9.4969192	9.9774609	9.5194583	10.4805417	42
19	9.4973010	9.9774191	9.5198819	10.4801181	41
20	9.4976824	9.9773772	9.5203052	10.4796948	40
21	9.4980635	9.9773354	9.5207282	10.4792718	39
22	9.4984442	9.9772934	9.5211508	10.4788492	38
23	9.4988245	9.9772515	9.5215730	10.4784270	37
24	9.4992045	9.9772095	9.5219950	10.4780050	36
25	9.4995840	9.9771674	9.5224166	10.4775834	35
26	9.4999633	9.9771253	9.5228379	10.4771621	34
27	9.5003421	9.9770832	9.5232589	10.4767411	33
28	9.5007206	9.9770410	9.5236795	10.4763205	32
29	9.5010987	9.9769988	9.5240999	10.4759001	31
30	9.5014764	9.9769566	9.5245199	10.4754801	30
31	9.5018538	9.9769143	9.5249395	10.4750605	29
32	9.5022308	9.9768720	9.5253589	10.4746411	28
33	9.5026075	9.9768296	9.5257779	10.4742221	27
34	9.5029838	9.9767872	9.5261966	10.4738034	26
35	9.5033597	9.9767447	9.5266150	10.4733850	25
36	9.5037353	9.9767022	9.5270331	10.4729669	24
37	9.5041105	9.9766597	9.5274508	10.4725492	23
38	9.5044853	9.9766171	9.5278682	10.4721318	22
39	9.5048598	9.9765745	9.5282853	10.4717147	21
40	9.5052339	9.9765318	9.5287021	10.4712979	20
41	9.5056077	9.9764891	9.5291186	10.4708814	19
42	9.5059811	9.9764464	9.5295347	10.4704653	18
43	9.5063542	9.9764036	9.5299505	10.4700495	17
44	9.5067268	9.9763608	9.5303661	10.4696339	16
45	9.5070992	9.9763179	9.5307813	10.4692187	15
46	9.5074712	9.9762750	9.5311961	10.4688039	14
47	9.5078428	9.9762321	9.5316107	10.4683893	13
48	9.5082141	9.9761891	9.5320250	10.4679750	12
49	9.5085850	9.9761461	9.5324389	10.4675611	11
50	9.5089556	9.9761030	9.5328526	10.4671474	10
51	9.5093258	9.9760599	9.5332659	10.4667341	9
52	9.5096956	9.9760167	9.5336789	10.4663211	8
53	9.5100651	9.9759736	9.5340916	10.4659084	7
54	9.5104343	9.9759303	9.5345040	10.4654960	6
55	9.5108031	9.9758870	9.5349161	10.4650839	5
56	9.5111716	9.9758437	9.5353278	10.4646722	4
57	9.5115397	9.9758004	9.5357393	10.4642607	3
58	9.5119074	9.9757570	9.5361505	10.4638495	2
59	9.5122749	9.9757135	9.5365613	10.4634387	1
60	9.5126419	9.9756701	9.5369719	10.4630281	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	71 Degrees				

Min.	19 Degrees.				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5126419	9.9756710	9.5369718	10.4630282	60
1	9.5130086	9.9756265	9.5373821	10.4626129	59
2	9.5133750	9.9755830	9.5377920	10.4621080	58
3	9.5137410	9.9755394	9.5382017	10.4617983	57
4	9.5141067	9.9754957	9.5386110	10.4613890	56
5	9.5144721	9.9754521	9.5390200	10.4609800	55
6	9.5148371	9.9754083	9.5394287	10.4605713	54
7	9.5152017	9.9753646	9.5398371	10.4601629	53
8	9.5155660	9.9753208	9.5402453	10.4597547	52
9	9.5159300	9.9752769	9.5406531	10.4593469	51
10	9.5162936	9.9752330	9.5410606	10.4589394	50
11	9.5166569	9.9751891	9.5414678	10.4585322	49
12	9.5170198	9.9751451	9.5418747	10.4581253	48
13	9.5173824	9.9751011	9.5422813	10.4577187	47
14	9.5177447	9.9750570	9.5426877	10.4573123	46
15	9.5181066	9.9750129	9.5430937	10.4569063	45
16	9.5184682	9.9749688	9.5434994	10.4565006	44
17	9.5188295	9.9749246	9.5439048	10.4560952	43
18	9.5191904	9.9748804	9.5443100	10.4556900	42
19	9.5195510	9.9747361	9.5447148	10.4552852	41
20	9.5199112	9.9747018	9.5451193	10.4548807	40
21	9.5202711	9.9747475	9.5455236	10.4544764	39
22	9.5206307	9.9747031	9.5459276	10.4540724	38
23	9.5209899	9.9746587	9.5463312	10.4536688	37
24	9.5213488	9.9746142	9.5467346	10.4532654	36
25	9.5217074	9.9745697	9.5471377	10.4528623	35
26	9.5220656	9.9745252	9.5475405	10.4524595	34
27	9.5224235	9.9744806	9.5479430	10.4520570	33
28	9.5227811	9.9744359	9.5483452	10.4516548	32
29	9.5231383	9.9743913	9.5487471	10.4512529	31
30	9.5234953	9.9743466	9.5491487	10.4508513	30
31	9.5238518	9.9743018	9.5495500	10.4504500	29
32	9.5242081	9.9742570	9.5499511	10.4500489	28
33	9.5245640	9.9742122	9.5503519	10.4496481	27
34	9.5249196	9.9741673	9.5507523	10.4492477	26
35	9.5252745	9.9741224	9.5511525	10.4488475	25
36	9.5256298	9.9740774	9.5515524	10.4484476	24
37	9.5259844	9.9740324	9.5519521	10.4480479	23
38	9.5263387	9.9739873	9.5523514	10.4476486	22
39	9.5266927	9.9739422	9.5527504	10.4472496	21
40	9.5270463	9.9738971	9.5531492	10.4468508	20
41	9.5273997	9.9738519	9.5535477	10.4464523	19
42	9.5277526	9.9738067	9.5539459	10.4460541	18
43	9.5281053	9.9737615	9.5543438	10.4456562	17
44	9.5284577	9.9737162	9.5547415	10.4452585	16
45	9.5288097	9.9736709	9.5551388	10.4448612	15
46	9.5291614	9.9736255	9.5555359	10.4444641	14
47	9.5295128	9.9735801	9.5559327	10.4440673	13
48	9.5298638	9.9735346	9.5563292	10.4436708	12
49	9.5302146	9.9734891	9.5567255	10.4432745	11
50	9.5305650	9.9734435	9.5571214	10.4428786	10
51	9.5309151	9.9733980	9.5575171	10.4424829	9
52	9.5312649	9.9733523	9.5579125	10.4420875	8
53	9.5316143	9.9733067	9.5583077	10.4416923	7
54	9.5319635	9.9732610	9.5587025	10.4412975	6
55	9.5323123	9.9732152	9.5590971	10.4409029	5
56	9.5326608	9.9731694	9.5594914	10.4405086	4
57	9.5330090	9.9731236	9.5598854	10.4401146	3
58	9.5333569	9.9730777	9.5602792	10.4397208	2
59	9.5337044	9.9730318	9.5606727	10.4393273	1
60	9.5340517	9.9739858	9.5610659	10.4389341	0
	Sine Comp.	Sine.	Tang Comp.	Tang	Min.
	70 Degrees				

Min.	20 Degrees. Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5340517	9.9729858	9.5610659	10.4389341	60
1	9.5343986	9.9729398	9.5614588	10.4385412	59
2	9.5347452	9.9728938	9.5618515	10.4381485	58
3	9.5350915	9.9728477	9.5622439	10.4377561	57
4	9.5354375	9.9728016	9.5626360	10.4373640	56
5	9.5357832	9.9727554	9.5630278	10.4369722	55
6	9.5361286	9.9727092	9.5634194	10.4365806	54
7	9.5364737	9.9726629	9.5638107	10.4361893	53
8	9.5368184	9.9726166	9.5642018	10.4357982	52
9	9.5371628	9.9725703	9.5645925	10.4354075	51
10	9.5375069	9.9725239	9.5649831	10.4350169	50
11	9.5378508	9.9724775	9.5653733	10.4346267	49
12	9.5381943	9.9724310	9.5657633	10.4342367	48
13	9.5385375	9.9723845	9.5661530	10.4338470	47
14	9.5388804	9.9723380	9.5665424	10.4334576	46
15	9.5392230	9.9722914	9.5669316	10.4330684	45
16	9.5395653	9.9722448	9.5673205	10.4326795	44
17	9.5399073	9.9721981	9.5677091	10.4322909	43
18	9.5402489	9.9721514	9.5680975	10.4319025	42
19	9.5405903	9.9721047	9.5684856	10.4315144	41
20	9.5409314	9.9720579	9.5688735	10.4311265	40
21	9.5412721	9.9720110	9.5692611	10 4307389	39
22	9.5416126	9.9719642	9.5696484	10.4303516	38
23	9.5419527	9.9719172	9.5700355	10.4299645	37
24	9.5422926	9.9718703	9.5704223	10.4295777	36
25	9.5426321	9.9718233	9.5708088	10.4291912	35
26	9.5429713	9.9717762	9.5711951	10.4288049	34
27	9.5433103	9.9717291	9.5715811	10.4284189	33
28	9.5436489	9.9716820	9.5719669	10.4280331	32
29	9.5439873	9.9716348	9.5723524	10.4276476	31
30	9.5443523	9.9715876	9.5727377	10.4272623	30
31	9.5446630	9.9715404	9.5731227	10.4268773	29
32	9.5450005	9.9714931	9.5735074	10.4264926	28
33	9.5453376	9.9714457	9.5738919	10 4261081	27
34	9.5456745	9.9713984	9.5742761	10.4257239	26
35	9.5460110	9.9713509	9.5746601	10.4253399	25
36	9.5463472	9.9713035	9.5750438	10.4249562	24
37	9.5466832	9.9712560	9.5754272	10.4245728	23
38	9.5470189	9.9712084	9.5758104	10.4241896	22
39	9.5473542	9.9711608	9.5761934	10.4238066	21
40	9.5476893	9.9711132	9.5765761	10.4234239	20
41	9.5480240	9.9710655	9.5769595	10.4230415	19
42	9.5483585	9.9710178	9.5773407	10.4226593	18
43	9.5486927	9.9709701	9.5777226	10.4222774	17
44	9.5490266	9.9709223	9.5781043	10.4218957	16
45	9.5493602	9.9708744	9.5784858	10.4215142	15
46	9.5496935	9.9708265	9.5788669	10.4211331	14
47	9.5500265	9.9707786	9.5792479	10.4207521	13
48	9.5503592	9.9707306	9.5796286	10.4203714	12
49	9.5506916	9.9706826	9.5800090	10.4199910	11
50	9 5510237	9.9706346	9.5803892	10.4196108	10
51	9.5513556	9.9705865	9.5807691	10.4192309	9
52	9.5516871	9.9705383	9.5811488	10.4188512	8
53	9.5520184	9.9704902	9.5815282	10.4184718	7
54	9.5523494	9.9704419	9.5819074	10.4180926	6
55	9.5526801	9.9703937	9.5822864	10.4177136	5
56	9.5530105	9.9703454	9.5826651	10.4173349	4
57	9.5533406	9.9702970	9.5830435	10.4169565	3
58	9.5536704	9.9702486	9.5834217	10.4165783	2
59	9.5539999	9.9702002	9.5837997	10.4162003	1
60	9.5543292	9.9701517	9.5841774	10.4158226	0
	Sine Comp.	Sine.	Tang Comp.	Tang.	Min.
	69 Degrees.				

Min.	21 Degrees Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5543292	9.9701517	9.5841774	10.4158226	60
1	9.5546581	9.9701032	9.5845549	10.4154451	59
2	9.5549868	9.9700547	9.5849321	10.4150679	58
3	9.5553152	9.9700061	9.5853091	10.4146909	57
4	9.5556433	9.9699574	9.5856859	10.4143141	56
5	9.5559711	9.9699087	9.5860624	10.4139376	55
6	9.5562987	9.9698600	9.5864386	10.4135614	54
7	9.5566259	9.9698112	9.5868147	10.4131853	53
8	9.5569529	9.9697624	9.5871904	10.4128096	52
9	9.5572796	9.9697136	9.5875660	10.4124340	51
10	9.5576060	9.9696647	9.5879413	10.4120587	50
11	9.5579321	9.9696158	9.5883163	10.4116837	49
12	9.5582579	9.9695668	9.5886912	10.4113088	48
13	9.5585835	9.9695177	9.5890657	10.4109343	47
14	9.5589088	9.9694687	9.5894401	10.4105599	46
15	9.5592338	9.9694196	9.5898142	10.4101858	45
16	9.5595585	9.9693704	9.5901881	10.4098119	44
17	9.5598829	9.9693212	9.5905617	10.4094383	43
18	9.5602071	9.9692720	9.5909351	10.4090649	42
19	9.5605310	9.9692227	9.5913082	10.4086918	41
20	9.5608546	9.9691734	9.5916812	10.4083188	40
21	9.5611779	9.9691241	9.5920539	10.4079461	39
22	9.5615010	9.9690746	9.5924263	10.4075737	38
23	9.5618237	9.9690252	9.5927985	10.4072015	37
24	9.5621462	9.9689757	9.5931705	10.4063295	36
25	9.5624685	9.9689262	9.5935423	10.4064577	35
26	9.5627904	9.9688766	9.5939138	10.4060862	34
27	9.5631121	9.9688270	9.5942851	10.4057149	33
28	9.5634335	9.9687773	9.5946561	10.4053439	32
29	9.5637546	9.9687276	9.5950269	10.4049731	31
30	9.5640754	9.9686779	9.5953975	10.4046025	30
31	9.5643960	9.9686281	9.5957679	10.4042321	29
32	9.5647163	9.9685783	9.5961380	10.4038620	28
33	9.5650363	9.9685284	9.5965079	10.4034921	27
34	9.5653561	9.9684785	9.5968776	10.4031224	26
35	9.5656756	9.9684286	9.5972470	10.4027530	25
36	9.5659948	9.9683786	9.5976162	10.4023838	24
37	9.5663137	9.9683285	9.5979852	10.4020148	23
38	9.5666324	9.9682784	9.5983540	10.4016460	22
39	9.5669508	9.9682283	9.5987225	10.4012775	21
40	9.5672689	9.9681781	9.5990908	10.4009092	20
41	9.5675868	9.9681279	9.5994588	10.4005412	19
42	9.5679044	9.9680777	9 5998267	10.4001733	18
43	9.5682217	9.9680274	9 6001943	10.3998057	17
44	9.5685387	9.9679771	9 6005617	10.3994383	16
45	9.5688555	9.9679267	9 6009289	10.3990711	15
46	9.5691721	9.9678763	9.6012958	10.3987042	14
47	9.5694883	9.9678258	9.6016625	10.3983375	13
48	9.5698043	9.9677753	9.6020290	10.3979710	12
49	9.5701200	9.9677247	9.6023953	10.3976047	11
50	9.5704355	9.9676741	9.6027613	10.3972387	10
51	9.5707506	9.9676235	9.6031271	10.3968729	9
52	9.5710656	9 9675728	9.6034927	10.3965073	8
53	9.5713802	9.9675221	9.6038581	10.3961419	7
54	9.5716946	9.9674713	9.6042233	10.3957767	6
55	9.5720087	9.9674205	9.6045882	10.3954118	5
56	9.5723226	9.9673697	9.6049529	10.3950471	4
57	9.5726362	9.9673188	9.6053174	10.3946826	3
58	9.5729495	9.9672679	9.6056817	10.3943183	2
59	9.5732626	9.9672169	9.6060457	10.3939543	1
60	9.5735754	9.9671659	9.6064096	10.3935904	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	68 Degrees.				

Min.	22 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5735754	9.9671659	9.6064096	10.3935904	60
1	9.5738880	9.9671148	9.6067732	10.3932268	59
2	9.5742003	9.9670637	9.6071366	10.3928634	58
3	9.5745123	9.9670125	9.6074997	10.3925003	57
4	9.5748240	9.9669614	9.6078627	10.3921373	56
5	9.5751356	9.9669101	9.6082254	10.3917746	55
6	9.5754468	9.9668588	9.6085880	10.3914120	54
7	9.5757578	9.9668075	9.6089503	10.3910497	53
8	9.5760685	9.9667562	9.6093124	10.3906876	52
9	9.5763790	9.9667048	9.6096742	10.3903258	51
10	9.5766892	9.9666533	9.6100359	10.3899641	50
11	9.5769991	0.9666018	9.6103973	10.3896027	49
12	9.5773088	9.9665503	9.6107586	10.3892414	48
13	9.5776183	9.9664986	9.6111196	10.3888804	47
14	9.5779275	9.9664471	9.6114804	10.3885196	46
15	9.5782364	9.9663954	9.6118409	10.3881591	45
16	9.5785450	9.9663437	9.6122013	10.3877987	44
17	9.5788535	9.9662920	9.6125615	10.3874385	43
18	9.5791616	9.9662402	9.6129214	10.3870786	42
19	9.5794695	9.9661884	9.6132812	10.3867188	41
20	9.5797772	9.9661365	9.6136407	10.3863593	40
21	9.5800845	9.9660846	9.6140000	10.3860000	39
22	9.5803917	9.9660326	9.6143591	10.3856409	38
23	9.5806986	9.9659806	9.6147180	10.3852820	37
24	9.5810052	9.9659285	9.6150766	10.3849234	36
25	9.5813116	9.9658764	9.6154351	10.3845649	35
26	9.5816177	9.9658243	9.6157934	10.3842066	34
27	9.5819236	9.9657721	9.6161514	10.3838486	33
28	9.5822292	9.9657199	9.6165093	10.3834907	32
29	9.5825345	9.9656677	9.6168669	10.3831331	31
30	9.5828397	9.9656153	9.6172243	10.3827757	30
31	9.5831445	9.9655630	9.6175815	10.3824185	29
32	9.5834491	9.9655106	9.6179385	10.3820615	28
33	9.5837535	9.9654582	9.6182953	10.3817047	27
34	9.5840576	9.9654057	9.6186519	10.3813481	26
35	9.5843615	9.9653532	9.6190083	10.3809917	25
36	9.5846651	9.9653006	9.6193645	10.3806355	24
37	9.5849685	9.9652480	9.6197205	10.3802795	23
38	9.5852716	9.9651953	9.6200762	10.3799238	22
39	9.5855745	9.9651426	9.6204318	10.3795682	21
40	9.5858771	9.9650899	9.6207872	10.3792128	20
41	9.5861795	9.9650371	9.6211423	10.3788577	19
42	9.5864816	9.9649843	9.6214974	10.3785026	18
43	9.5867835	9.9649314	9.6218520	10.3781480	17
44	9.5870851	9.9648785	9.6222066	10.3777934	16
45	9.5873865	9.9648256	9.6225609	10.3774391	15
46	9.5876876	9.9647726	9.6229150	10.3770850	14
47	9.5879885	9.9647195	9.6232690	10.3767310	13
48	9.5882892	9.9646665	9.6236227	10.3763773	12
49	9.5885896	9.9646133	9.6239763	10.3760237	11
50	9.5888897	9.9645602	9.6243296	10.3756704	10
51	9.5891897	9.9645069	9.6246827	10.3753173	9
52	9.5894893	9.9644537	9.6250356	10.3749644	8
53	9.5897888	9.9644004	9.6253884	10.3746116	7
54	9.5900880	9.9643470	9.6257409	10.3742591	6
55	9.5903869	9.9642937	9.6260932	10.3739068	5
56	9.5906856	9.9642402	9.6264454	10.3735546	4
57	9.5909841	9.9641868	9.6267973	10.3732027	3
58	9.5912823	9.9641332	9.6271491	10.3728509	2
59	9.5915803	9.9640797	9.6275006	10.3724994	1
60	9.5918780	9.9640261	9.6278519	10.3721481	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	67 Degrees				

Min.	23 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5918780	9.9640261	9.6278519	10.3721481	60
1	9.5921755	9.9639724	9.6282031	10.3717969	59
2	9.5924728	9.9639187	9.6285540	10.3714460	58
3	9.5927698	9.9638650	9.6289048	10.3710952	57
4	9.5930666	9.9638112	9.6292553	10.3707447	56
5	9.5933631	9.9637574	9.6296057	10.3703943	55
6	9.5936594	9.9637036	9.6299558	10.3700442	54
7	9.5939555	9.9636496	9.6303058	10.3696942	53
8	9.5942513	9.9635957	9.6306556	10.3693444	52
9	9.5945469	9.9635417	9.6310052	10.3689948	51
10	9.5948422	9.9634877	9.6313545	10.3686455	50
11	9.5951373	9.9634336	9.6317037	10.3682963	49
12	9.5954322	9.9633795	9.6320527	10.3679473	48
13	9.5957268	9.9633253	9.6324015	10.3675985	47
14	9.5960212	9.9632711	9.6327501	10.3672499	46
15	9.5963154	9.9632168	9.6330985	10.3669015	45
16	9.5966093	9.9631625	9.6334468	10.3665532	44
17	9.5969030	9.9631082	9.6337948	10.3662052	43
18	9.5971965	9.9630538	9.6341426	10.3658574	42
19	9.5974897	9.9629994	9.6344903	10.3655097	41
20	9.5977827	9.9629449	9.6348378	10.3651622	40
21	9.5980754	9.9628904	9.6351850	10.3648150	39
22	9.5983679	9.9628358	9.6355321	10.3644679	38
23	9.5986602	9.9627812	9.6358790	10.3641210	37
24	9.5989523	9.9627266	9.6362257	10.3637743	36
25	9.5992441	9.9626719	9.6365722	10.3634278	35
26	9.5995357	9.9626172	9.6369185	10.3630815	34
27	9.5998271	9.9625624	9.6372646	10.3627354	33
28	9.6001181	9.9625076	9.6376106	10.3623894	32
29	9.6004090	9.9624527	9.6379563	10.3620437	31
30	9.6006997	9.9623978	9.6383019	10.3616981	30
31	9.6009901	9.9623428	9.6386473	10.3613527	29
32	9.6012803	9.9622878	9.6389925	10.3610075	28
33	9.6015703	9.9622328	9.6393375	10.3606625	27
34	9.6018600	9.9621777	9.6396823	10.3603177	26
35	9.6021495	9.9621226	9.6400269	10.3599731	25
36	9.6024388	9.9620674	9.6403714	10.3596286	24
37	9.6027278	9.9620112	9.6407156	10.3592844	23
38	9.6030166	9.9619569	9.6410597	10.3589403	22
39	9.6033052	9.9619016	9.6414036	10.3585964	21
40	9.6035936	9.9618463	9.6417473	10.3582527	20
41	9.6038817	9.9617909	9.6420908	10.3579092	19
42	9.6041696	9.9617355	9.6424342	10.3575658	18
43	9.6044573	9.9616800	9.6427773	10.3572227	17
44	9.6047448	9.9616245	9.6431203	10.3568797	16
45	9.6050320	9.9615689	9.6434631	10.3565369	15
46	9.6053190	9.9615133	9.6448057	10.3561943	14
47	9.6056057	9.9614576	9.6441481	10.3558519	13
48	9.6058923	9.9614020	9.6444903	10.3550597	12
49	9.6061786	9.9613463	9.6448324	10.3551676	11
50	9.6064647	9.9612904	9.6451743	10.3548257	10
51	9.6067500	9.9612346	9.6455160	10.3544840	9
52	9.6070362	9.9611787	9.6458575	10.3541425	8
53	9.6073216	9.9611228	9.6461988	10.3538012	7
54	9.6076068	9.9610668	9.6465400	10.3534600	6
55	9.6078918	9.9610108	9.6468810	10.3531190	5
56	9.6081765	9.9609548	9.6472217	10.3527783	4
57	9.6084611	9.9608987	9.6475624	10.3524376	3
58	9.6087454	9.9608426	9.6479028	10.3520972	2
59	9.6090294	9.9607864	9.6482431	10.3517569	1
60	9.6093133	9.9607302	9.6485831	10.3514169	0
	Sine Comp.	Sine	Tang. Comp.	Tang	Min.
	66 Degrees				

Min.	Sine	Sine Comp.	Tang.	Tang. Com.	
	24 Degrees				
0	9.6093133	9.9607302	9.6485831	10.3514169	60
1	9.6095969	9.9606739	9.6489230	10.3510770	59
2	9.6098803	9.9606176	9.6492628	10.3507372	58
3	9.6101635	9.9605612	9.6496023	10.3503977	57
4	9.6104465	9.9605048	9.6499417	10.3500583	56
5	9.6107293	9.9604484	9.6502809	10.3497191	55
6	9.6110118	9.9603919	9.6506199	10.3493801	54
7	9.6112941	9.9603354	9.6509587	10.3490413	53
8	9.6115762	9.9602788	9.6512974	10.3487026	52
9	9.6118580	9.9602222	9.6516359	10.3483641	51
10	9.6121397	9.9601655	9.6519742	10.3480258	50
11	9.6124211	9.9601088	9.6523123	10.3476877	49
12	9.6127023	9.9600520	9.6526503	10.3473497	48
13	9.6129833	9.9599952	9.6529881	10.3470119	47
14	9.6132641	9.9599384	9.6533257	10.3466743	46
15	9.6135446	9.9598815	9.6536631	10.3463369	45
16	9.6138250	9.9598246	9.6540004	10.3459996	44
17	9.6141051	9.9597676	9.6543375	10.3456625	43
18	9.6143850	9.9597106	9.6546744	10.3453256	42
19	9.6146647	9.9596535	9.6550112	10.3449888	41
20	9.6149441	9.9595964	9.6553477	10.3446523	40
21	9.6152234	9.9595393	9.6556841	10.3443159	39
22	9.6155024	9.9594821	9.6560204	10.3439796	38
23	9.6157812	9.9594248	9.6563564	10.3436436	37
24	9.6160598	9.9593675	9.6566923	10.3433077	36
25	9.6163382	9.9593102	9.6570280	10.3429720	35
26	9.6166164	9.9592528	9.6573636	10.3426364	34
27	9.6168944	9.9591954	9.6576989	10.3423011	33
28	9.6171721	9.9591380	9.6580341	10.3419659	32
29	9.6174496	9.9590805	9.6583692	10.3416308	31
30	9.6177270	9.9590229	9.6587041	10.3412960	30
31	9.6180041	9.9589653	9.6590387	10.3409613	29
32	9.6182809	9.9589077	9.6593733	10.3406267	28
33	9.6185576	9.9588500	9.6597076	10.3402924	27
34	9.6188341	9.9587923	9.6600418	10.3399582	26
35	9.6191103	9.9587345	9.6603758	10.3396242	25
36	9.6193864	9.9586767	9.6607097	10.3392903	24
37	9.6196622	9.9586188	9.6610434	10.3389566	23
38	9.6199378	9.9585609	9.6613769	10.3386231	22
39	9.6202132	9.9585030	9.6617103	10.3382897	21
40	9.6204884	9.9584450	9.6620434	10.3379566	20
41	9.6207634	9.9583869	9.6623765	10.3376235	19
42	9.6210382	9.9583288	9.6627093	10.3372907	18
43	9.6213127	9.9582707	9.6630420	10.3369580	17
44	9.6215871	9.9582125	9.6633745	10.3366255	16
45	9.6218612	9.9581543	9.6637069	10.3362931	15
46	9.6221351	9.9580961	9.6640391	10.3359609	14
47	9.6224088	9.9580378	9.6643711	10.3356289	13
48	9.6226824	9.9579794	9.6647030	10.3352970	12
49	9.6229557	9.9579210	9.6650346	10.3349654	11
50	9.6232287	9.9578626	9.6653662	10.3346338	10
51	9.6235016	9.9578041	9.6656975	10.3343025	9
52	9.6237743	9.9577456	9.6660288	10.3339712	8
53	9.6240467	9.9576870	9.6663598	10.3336402	7
54	9.6243190	9.9576284	9.6666907	10.3333093	6
55	9.6245911	9.9575697	9.6670214	10.3329786	5
56	9.6248629	9.9575110	9.6673519	10.3326481	4
57	9.6251346	9.9574522	9.6676823	10.3323177	3
58	9.6254060	9.9573934	9.6680126	10.3319874	2
59	9.6256772	9.9573346	9.6683426	10.3316574	1
60	9.6259483	9.9572757	9.6686725	10.3313275	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	65 Degrees				

Min.	Sine	Sine Comp.	Tang	Tang. Comp.	
	25 Degrees				
0	9.6259483	9.9572757	9.6686725	10.3313275	60
1	9.6262191	9.9572168	9.6690023	10.3309977	59
2	9.6264897	9.9571578	9.6693319	10.3306681	58
3	9.6267601	9.9570988	9.6696613	10.3303387	57
4	9.6270303	9.9570397	9.6699906	10.3300094	56
5	9.6273003	9.9569806	9.6703197	10.3296803	55
6	9.6275701	9.9569215	9.6706486	10.3293514	54
7	9.6278397	9.9568623	9.6709774	10.3290226	53
8	9.6281090	9.9568030	9.6713060	10.3286940	52
9	9.6283782	9.9567437	9.6716345	10.3283655	51
10	9.6286472	9.9566844	9.6719628	10.3280372	50
11	9.6289160	9.9566250	9.6722910	10.3277090	49
12	9.6291845	9.9565656	9.6726190	10.3273810	48
13	9.6294529	9.9565061	9.6729468	10.3270532	47
14	9.6297211	9.9564466	9.6732745	10.3267255	46
15	9.6299890	9.9563870	9.6736020	10.3263980	45
16	9.6302568	9.9563274	9.6739294	10.3260706	44
17	9.6305243	9.9562678	9.6742566	10.3257434	43
18	9.6307917	9.9562081	9.6745836	10.3254164	42
19	9.6310589	9.9561483	9.6749105	10.3250895	41
20	9.6313258	9.9560886	9.6752372	10.3247628	40
21	9.6315926	9.9560287	9.6755638	10.3244362	39
22	9.6318591	9.9559689	9.6758903	10.3241097	38
23	9.6321255	9.9559089	9.6762165	10.3237835	37
24	9.6323916	9.9558490	9.6765426	10.3234574	36
25	9.6326576	9.9557890	9.6768686	10.3231314	35
26	9.6329233	9.9557289	9.6771944	10.3228056	34
27	9.6331889	9.9556688	9.6775201	10.3224799	33
28	9.6334542	9.9556087	9.6778456	10.3221544	32
29	9.6337194	9.9555485	9.6781709	10.3218291	31
30	9.6339844	9.9554882	9.6784961	10.3215039	30
31	9.6342491	9.9554280	9.6788211	10.3211789	29
32	9.6345137	9.9553676	9.6791460	10.3208540	28
33	9.6347780	9.9553073	9.6794708	10.3205292	27
34	9.6350422	9.9552469	9.6797953	10.3202047	26
35	9.6353062	9.9551864	9.6801188	10.3198802	25
36	9.6355699	9.9551259	9.6804440	10.3195560	24
37	9.6358335	9.9550653	9.6807682	10.3192318	23
38	9.6360969	9.9550047	9.6810921	10.3189079	22
39	9.6363601	9.9549441	9.6814160	10.3185840	21
40	9.6366231	9.9548834	9.6817396	10.3182604	20
41	9.6368859	9.9548227	9.6820632	10.3179368	19
42	9.6371484	9.9547619	9.6823865	10.3176135	18
43	9.6374108	9.9547011	9.6827098	10.3172902	17
44	9.6376731	9.9546402	9.6830328	10.3169672	16
45	9.6379351	9.9545793	9.6833557	10.3166443	15
46	9.6381969	9.9545184	9.6836785	10.3163215	14
47	9.6384585	9.9544574	9.6840011	10.3159989	13
48	9.6387199	9.9543963	9.6843236	10.3156764	12
49	9.6389812	9.9543352	9.6846459	10.3153541	11
50	9.6392422	9.9542741	9.6849681	10.3150319	10
51	9.6395030	9.9542129	9.6852901	10.3147099	9
52	9.6397637	9.9541517	9.6856120	10.3143880	8
53	9.6400241	9.9540904	9.6859338	10.3140662	7
54	9.6402844	9.9540291	9.6862553	10.3137447	6
55	9.6405445	9.9539677	9.6865768	10.3134232	5
56	9.6408044	9.9539063	9.6868981	10.3131019	4
57	9.6410640	9.9538448	9.6872192	10.3127808	3
58	9.6413235	9.9537833	9.6875402	10.3124598	2
59	9.6415828	9.9537218	9.6878611	10.3121389	1
60	9.6418420	9.9536602	9.6881818	10.3118182	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	64 Degrees				

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
	26 Degrees				
0	9.6418420	9.9536602	9.6881818	10.3118182	60
1	9.6421009	9.9535985	9.6885023	10.3114977	59
2	9.6423596	9.9535369	9.6888227	10.3111773	58
3	9.6426182	9.9534751	9.6891430	10.3108570	57
4	9.6428765	9.9534134	9.6894631	10.3105369	56
5	9.6431347	9.9533515	9.6897831	10.3102169	55
6	9.6433926	9.9532897	9.6901030	10.3098970	54
7	9.6436504	9.9532278	9.6904226	10.3095774	53
8	9.6439080	9.9531658	9.6907422	10.3092578	52
9	9.6441654	9.9531038	9.6910616	10.3089384	51
10	9.6444226	9.9530418	9.6913809	10.3086191	50
11	9.6446796	9.9529797	9.6917000	10.3083000	49
12	9.6449365	9.9529175	9.6920189	10.3079811	48
13	9.6451931	9.9528553	9.6923378	10.3076622	47
14	9.6454496	9.9527931	9.6926565	10.3073435	46
15	9.6457058	9.9527308	9.6929750	10.3070250	45
16	9.6459619	9.9526685	9.6932934	10.3067066	44
17	9.6462178	9.9526061	9.6936117	10.3063883	43
18	9.6464735	9.9525437	9.6939298	10.3060702	42
19	9.6467290	9.9524813	9.6942478	10.3057522	41
20	9.6469844	9.9524188	9.6945656	10.3054344	40
21	9.6472395	9.9523562	9.6948833	10.3051167	39
22	9.6474945	9.9522936	9.6952099	10.3047991	38
23	9.6477492	9.9522310	9.6955183	10.3044817	37
24	9.6480038	9.9521683	9.6958355	10.3041645	36
25	9.6482582	9.9521055	9.6961527	10.3038473	35
26	9.6485124	9.9520428	9.6964697	10.3035303	34
27	9.6487665	9.9519799	9.6967865	10.3032135	33
28	9.6490203	9.9519171	9.6971032	10.3028968	32
29	9.6492740	9.9518541	9.6974198	10.3025802	31
30	9.6495274	9.9517912	9.6977363	10.3022637	30
31	9.6497807	9.9517282	9.6980526	10.3019474	29
32	9.6500338	9.9516651	9.6983687	10.3016313	28
33	9.6502868	9.9516020	9.6986847	10.3013153	27
34	9.6505395	9.9515389	9.6990006	10.3009994	26
35	9.6507920	9.9514757	9.6993164	10.3006836	25
36	9.6510444	9.9514124	9.6996320	10.3003680	24
37	9.6512966	9.9513492	9.6999474	10.3000526	23
38	9.6515486	9.9512858	9.7002628	10.2997372	22
39	9.6518004	9.9512224	9.7005780	10.2994220	21
40	9.6520521	9.9511590	9.7008930	10.2991070	20
41	9.6523035	9.9510956	9.7012080	10.2987920	19
42	9.6525548	9.9510320	9.7015227	10.2984773	18
43	9.6528059	9.9509685	9.7018374	10.2981626	17
44	9.6530568	9.9509049	9.7021519	10.2978481	16
45	9.6533075	9.9508412	9.7024663	10.2975337	15
46	9.6535581	9.9507775	9.7027805	10.2972195	14
47	9.6538084	9.9507138	9.7030946	10.2969054	13
48	9.6540586	9.9506500	9.7034086	10.2965914	12
49	9.6543086	9.9505861	9.7037225	10.2962775	11
50	9.6545584	9.9505223	9.7040362	10.2959638	10
51	9.6548081	9.9504583	9.7043497	10.2956503	9
52	9.6550575	9.9503944	9.7046632	10.2953368	8
53	9.6553068	9.9503303	9.7049765	10.2950235	7
54	9.6555559	9.9502663	9.7052897	10.2947103	6
55	9.6558048	9.9502022	9.7056027	10.2943973	5
56	9.6560536	9.9501380	9.7059156	10.2940844	4
57	9.6563021	9.9500738	9.7062284	10.2937716	3
58	9.6565505	9.9500095	9.7065410	10.2934590	2
59	9.6567987	9.9499452	9.7068535	10.2931465	1
60	9.6570468	9.9498809	9.7071659	10.2928341	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	63 Degrees				

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
	27 Degrees				
0	9.6570468	9.9498809	9.7071659	10.2928341	60
1	9.6572946	9.9498165	9.7074781	10.2925219	59
2	9.6575423	9.9497521	9.7077902	10.2922098	58
3	9.6577898	9.9496876	9.7081022	10.2918978	57
4	9.6580371	9.9496230	9.7084141	10.2915859	56
5	9.6582842	9.9495585	9.7087258	10.2912752	55
6	9.6585312	9.9494938	9.7090374	10.2909626	54
7	9.6587780	9.9494292	9.7093488	10.2906512	53
8	9.6590246	9.9493645	9.7096601	10.2903399	52
9	9.6592710	9.9492997	9.7099713	10.2900287	51
10	9.6595173	9.9492349	9.7102824	10.2897176	50
11	9.6597634	9.9491700	9.7105933	10.2894067	49
12	9.6600093	9.9491051	9.7109041	10.2890959	48
13	9.6602550	9.9490402	9.7112148	10.2887852	47
14	9.6605005	9.9489752	9.7115254	10.2884746	46
15	9.6607459	9.9489101	9.7118358	10.2881642	45
16	9.6609911	9.9488450	9.7121461	10.2878539	44
17	9.6612361	9.9487799	9.7124562	10.2875438	43
18	9.6614810	9.9487147	9.7127662	10.2872338	42
19	9.6617257	9.9486495	9.7130761	10.2869239	41
20	9.6619702	9.9485842	9.7133859	10.2866141	40
21	9.6622145	9.9485189	9.7136956	10.2863044	39
22	9.6624586	9.9484535	9.7140051	10.2859949	38
23	9.6627026	9.9483881	9.7173145	10.2856855	37
24	9.6629464	9.9483227	9.7146237	10.2853763	36
25	9.6631900	9.9482572	9.7149329	10.2850671	35
26	9.6634335	9.9481916	9.7152419	10.2847581	34
27	9.6636768	9.9481260	9.7155508	10.2844492	33
28	9.6639199	9.9480604	9.7158595	10.2841405	32
29	9.6641628	9.9479947	9.7161682	10.2838318	31
30	9.6644056	9.9479289	9.7164767	10.2835233	30
31	9.6646482	9.9478631	9.7167851	10.2832149	29
32	9.6648906	9.9477973	9.7170933	10.2829067	28
33	9.6651329	9.9477314	9.7174014	10.2825986	27
34	9.6653749	9.9476655	9.7177094	10.2822906	26
35	9.6656168	9.9475995	9.7180173	10.2819827	25
36	9.6658586	9.9475335	9.7183251	10.2816749	24
37	9.6661001	9.9474674	9.7186327	10.2813673	23
38	9.6663415	9.9474013	9.7189402	10.2810598	22
39	9.6665828	9.9473352	9.7192476	10.2807524	21
40	9.6668238	9.9472689	9.7195549	10.2804451	20
41	9.6670647	9.9472027	9.7198620	10.2801380	19
42	9.6673054	9.9471364	9.7201690	10.2798310	18
43	9.6675459	9.9470700	9.7204759	10.2795241	17
44	9.6677863	9.9470036	9.7207827	10.2792173	16
45	9.6680265	9.9469372	9.7210893	10.2789107	15
46	9.6682665	9.9468707	9.7213958	10.2786042	14
47	9.6685064	9.9468042	9.7217022	10.2782978	13
48	9.6687461	9.9467376	9.7220085	10.2779915	12
49	9.6689856	9.9466710	9.7223147	10.2776853	11
50	9.6692250	9.9466043	9.7226207	10.2773793	10
51	9.6694642	9.9465376	9.7229266	10.2770734	9
52	9.6697032	9.9464708	9.7232324	10.2767676	8
53	9.6699420	9.9464040	9.7235381	10.2764619	7
54	9.6701807	9.9463371	9.7238436	10.2761564	6
55	9.6704192	9.9462702	9.7241490	10.2758510	5
56	9.6706576	9.9462032	9.7244543	10.2755457	4
57	9.6708958	9.9461362	9.7247595	10.2752405	3
58	9.6711338	9.9460692	9.7250646	10.2749354	2
59	9.6713716	9.9460021	9.7253695	10.2746305	1
60	9.6716093	9.9469349	9.7256744	10.2743256	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	62 Degrees				

Min.	28 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.6716093	9.9459349	9.7256744	10.2743256	60
1	9.6718468	9.9458677	9.7259791	10.2740209	59
2	9.6720841	9.9458005	9.7262837	10.2737163	58
3	9.6723213	9.9457332	9.7265881	10.2734119	57
4	9.6725583	9.9456659	9.7268925	10.2731075	56
5	9.6727952	9.9455985	9.7271967	10.2728033	55
6	9.6730319	9.9455310	9.7275008	10.2724992	54
7	9.6732684	9.9454636	9.7278048	10.2721952	53
8	9.6735047	9.9453960	9.7281087	10.2718913	52
9	9.6737409	9.9453285	9.7284124	10.2715876	51
10	9.6739769	9.9452609	9.7287161	10.2712839	50
11	9.6742128	9.9451932	9.7290196	10.2709804	49
12	9.6744485	9.9451255	9.7293230	10.2706770	48
13	9.6746840	9.9450577	9.7296263	10.2703737	47
14	9.6749194	9.9449899	9.7299295	10.2700705	46
15	9.6751546	9.9449220	9.7302325	10.2697675	45
16	9.6753896	9.9448541	9.7305354	10.2694646	44
17	9.6756245	9.9447862	9.7308383	10.2691617	43
18	9.6758592	9.9447182	9.7311410	10.2688590	42
19	9.6760937	9.9446501	9.7314436	10.2685564	41
20	9.6763281	9.9445821	9.7317460	10.2682540	40
21	9.6765623	9.9445139	9.7320484	10.2679516	39
22	9.6767963	9.9444457	9.7323506	10.2676494	38
23	9.6770302	9.9443775	9.7326527	10.2673473	37
24	9.6772640	9.9443092	9.7329547	10.2670453	36
25	9.6774975	9.9442409	9.7332566	10.2667434	35
26	9.6777309	9.9441725	9.7335584	10.2664416	34
27	9.6779642	9.9441041	9.7338601	10.2661399	33
28	9.6781972	9.9440356	9.7341616	10.2658384	32
29	9.6784301	9.9439671	9.7344631	10.2655369	31
30	9.6786629	9.9438985	9.7347644	10.2652356	30
31	9.6788955	9.9438299	9.7350656	10.2649344	29
32	9.6791279	9.9437612	9.7353667	10.2646333	28
33	9.6793602	9.9436925	9.7356677	10.2643323	27
34	9.6795923	9.9436238	9.7359685	10.2640315	26
35	9.6798243	9.9435549	9.7362693	10.2637307	25
36	9.6800560	9.9434861	9.7365699	10.2634301	24
37	9.6802877	9.9434172	9.7368705	10.2631295	23
38	9.6805191	9.9433482	9.7371709	10.2628291	22
39	9.6807504	9.9432792	9.7374712	10.2625288	21
40	9.6809816	9.9432102	9.7377714	10.2622286	20
41	9.6812126	9.9431411	9.7380715	10.2619285	19
42	9.6814434	9.9430720	9.7383714	10.2616286	18
43	9.6816741	9.9430028	9.7386713	10.2613287	17
44	9.6819046	9.9429335	9.7389710	10.2610290	16
45	9.6821349	9.9428643	9.7392707	10.2607293	15
46	9.6823651	9.9427949	9.7395702	10.2604298	14
47	9.6825952	9.9427255	9.7398696	10.2601304	13
48	9.6828250	9.9426561	9.7401689	10.2598311	12
49	9.6830548	9.9425866	9.7404681	10.2595319	11
50	9.6832843	9.9425171	9.7407672	10.2592328	10
51	9.6835137	9.9424476	9.7410662	10.2589338	9
52	9.6837430	9.9423779	9.7413650	10.2586350	8
53	9.6839720	9.9423083	9.7416638	10.2583362	7
54	9.6842010	9.9422386	9.7419624	10.2580376	6
55	9.6844297	9.9421688	9.7422609	10.2577391	5
56	9.6846583	9.9420990	9.7425594	10.2574406	4
57	9.6848868	9.9420291	9.7428577	10.2571423	3
58	9.6851151	9.9419592	9.7431559	10.2568441	2
59	9.6854432	9.9418893	9.7434540	10.2565460	1
60	9.6855712	9.9418193	9.7437520	10.2562480	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	61 Degrees				

Min.	29 Degrees				
	Sine	Sine Comp.	Tang.	Tang Comp.	
0	9.6855712	9.9418193	9.7437520	10.2562480	60
1	9.6857991	9.9417492	9.7440499	10.2559501	59
2	9.6860267	9.9416791	9.7443476	10.2556524	58
3	9.6862542	9.9416090	9.7446453	10.2553547	57
4	9.6864816	9.9415388	9.7449428	10.2550572	56
5	9.6867088	9.9414685	9.7452403	10.2547597	55
6	9.6869359	9.9413982	9.7455376	10.2544624	54
7	9.6871628	9.9413279	9.7458349	10.2541651	53
8	9.6873895	9.9412575	9.7461320	10.2538680	52
9	9.6876161	9.9411871	9.7464290	10.2535710	51
10	9.6878425	9.9411166	9.7467259	10.2532741	50
11	9.6880688	9.9410461	9.7470227	10.2529773	49
12	9.6882949	9.9409755	9.7473194	10.2526806	48
13	9.6885209	9.9409048	9.7476160	10.2523840	47
14	9.6887467	9.9408342	9.7479125	10.2520875	46
15	9.6889723	9.9407634	9.7482089	10.2517911	45
16	9.6891978	9.9406927	9.7485052	10.2514948	44
17	9.6894232	9.9406219	9.7488013	10.2511987	43
18	9.6896484	9.9405510	9.7490974	10.2509026	42
19	9.6898734	9.9404801	9.7493934	10.2506066	41
20	9.6900983	9.9404091	9.7496892	10.2503108	40
21	9.6903231	9.9403381	9.7499850	10.2500150	39
22	9.6905476	9.9402670	9.7502806	10.2497194	38
23	9.6907721	9.9401959	9.7505762	10.2494238	37
24	9.6909964	9.9401248	9.7508716	10.2491284	36
25	9.6912205	9.9400535	9.7511669	10.2488331	35
26	9.6914445	9.9399823	9.7514622	10.2485378	34
27	9.6916683	9.9399110	9.7517573	10.2482427	33
28	9.6918919	9.9398396	9.7520523	10.2479477	32
29	9.6921155	9.9397682	9.7523472	10.2476526	31
30	9.6923388	9.9396968	9.7526420	10.2473580	30
31	9.6925620	9.9396253	9.7529368	10.2470632	29
32	9.6927851	9.9395537	9.7532314	10.2467686	28
33	9.6930080	9.9394821	9.7535259	10.2464741	27
34	9.6932308	9.9394105	9.7538203	10.2461797	26
35	9.6934534	9.9393388	9.7541146	10.2458854	25
36	9.6936758	9.9392671	9.7544088	10.2455912	24
37	9.6938981	9.9391953	9.7547029	10.2452971	23
38	9.6941203	9.9391234	9.7549969	10.2450031	22
39	9.6943423	9.9390515	9.7552908	10.2447092	21
40	9.6945642	9.9389796	9.7555846	10.2444154	20
41	9.6947859	9.9389076	9.7558783	10.2441217	19
42	9.6950074	9.9388356	9.7561718	10.2438282	18
43	9.6952288	9.9387635	9.7564653	10.2435347	17
44	9.6954501	9.9386914	9.7567587	10.2432413	16
45	9.6956712	9.9386192	9.7570520	10.2429480	15
46	9.6958922	9.9385470	9.7573452	10.2426548	14
47	9.6961130	9.9384747	9.7576383	10.2423617	13
48	9.6963336	9.9384024	9.7579313	10.2420687	12
49	9.6965541	9.9383300	9.7582242	10.2417758	11
50	9.6967745	9.9382576	9.7585170	10.2414830	10
51	9.6969947	9.9381851	9.7588096	10.2411904	9
52	9.6972148	9.9381126	9.7591022	10.2408978	8
53	9.6974347	9.9380400	9.7593947	10.2406053	7
54	9.6976545	9.9379674	9.7596871	10.2403129	6
55	9.6978741	9.9378947	9.7599794	10.2400206	5
56	9.6980936	9.9378220	9.7602716	10.2397284	4
57	9.6983129	9.9377492	9.7605637	10.2364363	3
58	9.6985321	9.9376764	9.7608557	10.2391443	2
59	9.6987511	9.9376035	9.7611476	10.2388524	1
60	9.6989700	9.9375306	9.7614394	10.2385606	0
	Sine Comp.	Sine	Tang. Comp	Tang.	Min.
	60 Degrees				

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
	30 Degrees.				
0	9.6989700	9.9375306	9.7614394	10.2385606	60
1	9.6991887	9.9374577	9.7617311	10.2382689	59
2	9.6994073	9.9373847	9.7620227	10.2379773	58
3	9.6996258	9.9376116	9.7623142	10.2376858	57
4	9.6998441	9.9372385	9.7626056	10.2373944	56
5	9.7000622	9.9371653	9.7628969	10.2371031	55
6	9.7002802	9.9370921	9.7631881	10.2368119	54
7	9.7004981	9.9370189	9.7634792	10.2365208	53
8	9.7007158	9.9369456	9.7637702	10.2362298	52
9	9.7009334	9.9368722	9.7640612	10.2359388	51
10	9.7011508	9.9367988	9.7643520	10.2356480	50
11	9.7013681	9.9367254	9.7646427	10.2353573	49
12	9.7015852	9.9366519	9.7649334	10.2350666	48
13	9.7018022	9.9365783	9.7652239	10.2347761	47
14	9.7020190	9.9365047	9.7655143	10.2344857	46
15	9.7022357	9.9364311	9.7658047	10.2341953	45
16	9.7024523	9.9363574	9.7660949	10.2339051	44
17	9.7026687	9.9362836	9.7663851	10.2336149	43
18	9.7028849	9.9362298	9.7666751	10.2333249	42
19	9.7031011	9.9361360	9.7669651	10.2330349	41
20	9.7033170	9.9360621	9.7672550	10.2327450	40
21	9.7035329	9.9359881	9.7675448	10.2324552	39
22	9.7037486	9.9359141	9.7678344	10.2321656	38
23	9.7039641	9.9358401	9.7681240	10.2318760	37
24	9.7041795	9.9357660	9.7684135	10.2315865	36
25	9.7043947	9.9356918	9.7687029	10.2312971	35
26	9.7046099	9.9356177	9.7689922	10.2310078	34
27	9.7048248	9.9355434	9.7692814	10.2307186	33
28	9.7050397	9.9354691	9.7695705	10.2304295	32
29	9.7052543	9.9353948	9.7698596	10.2301404	31
30	9.7054689	9.9353204	9.7701485	10.2298515	30
31	9.7056833	9.9352459	9.7704373	10.2295627	29
32	9.7058975	9.9351715	9.7707261	10.2292739	28
33	9.7061116	9.9350969	9.7710147	10.2289853	27
34	9.7063256	9.9350223	9.7713033	10.2286967	26
35	9.7065394	9.9349477	9.7715917	10.2284083	25
36	9.7067531	9.9348730	9.7718801	10.2281199	24
37	9.7069667	9.9347983	9.7721684	10.2278316	23
38	9.7071801	9.9347235	9.7724566	10.2275434	22
39	9.7073933	9.9346486	9.7727447	10.2272553	21
40	9.7076064	9.9345738	9.7730327	10.2269673	20
41	9.7078194	9.9344988	9.7733206	10.2266794	19
42	9.7080323	9.9344238	9.7736084	10.2263916	18
43	9.7082450	9.9343488	9.7738961	10.2261039	17
44	9.7084575	9.9342737	9.7741838	10.2258162	16
45	9.7086699	9.9341986	9.7744713	10.2255287	15
46	9.7088822	9.9341234	9.7747588	10.2252412	14
47	9.7090943	9.9340482	9.7750462	10.2249538	13
48	9.7093063	9.9339729	9.7753334	10.2246666	12
49	9.7095182	9.9338976	9.7756206	10.2243794	11
50	9.7097299	9.9338222	9.7759077	10.2240923	10
51	9.7099415	9.9337467	9.7761947	10.2238053	9
52	9.7101529	9.9336713	9.7764816	10.2235184	8
53	9.7103642	9.9335957	9.7767685	10.2232315	7
54	9.7105753	9.9335201	9.7770552	10.2229448	6
55	9.7107863	9.9334445	9.7773418	10.2226582	5
56	9.7109972	9.9333688	9.7776284	10.2223716	4
57	9.7112080	9.9332931	9.7779149	10.2220851	3
58	9.7114186	9.9332173	9.7782012	10.2217988	2
59	9.7116290	9.9331415	9.7784875	10.2215125	1
60	9.7118393	9.9330656	9.7787737	10.2212263	0
	Sine Comp.	Sine.	Tang Comp.	Tang.	Min.
	59 Degrees.				

Min.	Sine	Sine Comp	Tang.	Tang. Comp.	
	31 Degrees				
0	9.7118393	9.9330656	9.7787737	10.2212263	60
1	9.7120495	9.9329897	9.7790599	10.2209401	59
2	9.7122596	9.9329137	9.7793459	10.2206541	58
3	9.7124695	9.9328376	9.7796318	10.2203682	57
4	9.7126792	9.9327616	9.7799177	10.2200823	56
5	9.7128889	9.9326854	9.7802034	10.2197966	55
6	9.7130983	9.9326092	9.7804891	10.2195109	54
7	9.7133077	9.9325330	9.7807747	10.2192253	53
8	9.7135169	9.9324567	9.7810602	10.2189398	52
9	9.7137260	9.9323804	9.7813456	10.2186544	51
10	9.7139349	9.9323040	9.7816309	19.2183691	50
11	9.7141437	9.9322276	9.7819162	10.2180838	49
12	9.7143524	9.9321511	9.7822013	10.2177987	48
13	9.7145609	9.9320746	9.7824864	10.2175136	47
14	9.7147693	9.9319980	9.7827713	10.2172287	46
15	9.7179776	9.9319213	9.7830562	10.2169438	45
16	9.7151857	9.9318447	9.7833410	10.2166590	44
17	9.7153937	9.9317679	9.7836258	10.2163742	43
18	9.7156015	9.9316911	9.8839104	10.2160896	42
19	9.7158092	9.9316143	9.7841949	10.2158051	41
20	9.7160168	9.9315374	9.7844794	10.2155206	40
21	9.7162243	9.9314605	9.7847638	10.2152362	39
22	9.7164316	9.9313835	9.7850481	10.2149519	38
23	9.7166387	9.9313065	9.7853323	10.2146677	37
24	9.7168458	9.9312294	9.7856164	10.2143836	36
25	9.7170526	9.9311522	9.7859004	10.2140996	35
26	9.7172594	9.9310750	9.7861844	10.2138156	34
27	9.7174660	9.9309978	9.7864682	10.2135318	33
28	9.7176725	9.9309205	9.7867520	10.2132480	32
29	9.7178789	9.9308432	9.7870357	10.2129643	31
30	9.7180851	9.9307658	9.7873193	10.2126807	30
31	9.7182912	9.9306883	9.7876028	10.2123972	29
32	9.7184971	9.9306109	9.7878863	10.2121137	28
33	9.7187030	9.9305333	9.7881696	10.2118304	27
34	9.7189086	9.9304557	9.7884529	10.2115471	26
35	9.7191142	9.9303781	9.7887361	10.2112639	25
36	9.7193196	9.9303004	9.7890192	10.2109808	24
37	9.7195249	9.9302226	9.7893023	10.2106977	23
38	9.7197300	9.9301448	9.7895852	10.2104148	22
39	9.7199350	9.9300670	9.7898681	10.2101319	21
40	9.7201399	9.9299891	9.7901508	10.2098492	20
41	9.7203447	9.9299112	9.7904335	10.2095665	19
42	9.7205493	9.9298332	9.7907161	10.2092839	18
43	9.7207538	9.9297551	9.7909987	10.2090013	17
44	9.7209581	9.9296770	9.7912811	10.2087189	16
45	9.7211623	9.9295989	9.7915635	10.2084365	15
46	9.7213664	9.9295207	9.7918458	10.2081542	14
47	9.7215704	9.9294424	9.7921280	10.2078720	13
48	9.7217742	9.9293641	9.7924101	10.2075899	12
49	9.7219779	9.9292857	9.7926921	10.2073079	11
50	9.7221814	9.9292073	9.7929741	10.2070259	10
51	9.7223848	9.9291289	9.7932560	10.2067440	9
52	9.7225881	9.9290504	9.7935378	10.2064622	8
53	9.7227913	9.9289718	9.7938195	10.2061805	7
54	9.7229943	9.9288932	9.7941011	10.2058989	6
55	9.7231972	9.9288145	9.7943827	10.2056173	5
56	9.7234000	9.9287358	9.7946641	10.2053359	4
57	9.7236026	9.9286571	9.7949455	10.2050545	3
58	9.7238051	9.9285783	9.7952268	10.2047732	2
59	9.7240075	9.9284994	9.7955081	10.2044919	1
60	9.7242097	9.9284205	9.7957892	10.2042108	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	58 Degrees.				

Min.	32 Degrees				
	Sine	Sine Comp	Tang.	Tang. Comp.	
0	9.7242097	9.9284205	9.7957892	10.2042108	60
1	9.7244118	9.9283415	9.7960703	10.2039297	59
2	9.7246138	9.9282625	9.7963513	10.2036487	58
3	9.7248156	9.9281834	9.7966322	10.2033678	57
4	9.7250174	9.9281043	9.7969130	10.2030870	56
5	9.7252189	9.9280251	9.7971938	10.2028062	55
6	9.7254204	9.9279459	9.7974745	10.2025255	54
7	9.7256217	9.9278666	9.7977551	10.2022449	53
8	9.7258229	9.9277873	9.7980356	10.2019644	52
9	9.7260240	9.9277079	9.7983160	10.2016840	51
10	9.7262249	9.9276285	9.7985964	10.2014036	50
11	9.7264257	9.9275490	9.7988767	10.2011233	49
12	9.7266264	9.9274695	9.7991569	10.2008431	48
13	9.7268269	9.9273899	9.7994370	10.2005630	47
14	9.7270273	9.9273103	9.7997170	10.2002830	46
15	9.7272276	9.9272306	9.7999970	10.2000030	45
16	9.7274278	9.9271509	9.8002769	10.1997231	44
17	9.7276278	9.9270711	9.8065567	10.1994433	43
18	9.7278277	9.9269913	9.8008365	10.1991635	42
19	9.7280275	9.9269114	9.8011161	10.1988839	41
20	9.7282271	9.9268514	9.8013957	10.1986043	40
21	9.7284267	9.9267514	9.8016752	10.1983248	39
22	9.7286260	9.9266714	9.8019546	10.1980454	38
23	9.7288253	9.9265913	9.8022340	10.1977660	37
24	9.7290244	9.9265112	9.8025133	10.1974867	36
25	9.7292234	9.9264310	9.8027925	10.1972075	35
26	9.7294223	9.9263507	9.8030716	10.1969284	34
27	9.7296211	9.9262704	9.8033506	10.1966494	33
28	9.7298197	9.9261901	9.8036296	10.1963704	32
29	9.7300182	9.9261096	9.8039085	10.1960915	31
30	9.7302165	9.9260292	9.8041873	10.1958127	30
31	9.7304148	9.9259487	9.8044661	10.1955339	29
32	9.7306129	9.9258681	9.8047447	10.1952553	28
33	9.7308109	9.9257875	9.8050233	10.1949767	27
34	9.7310087	9.9257069	9.8053019	10.1946981	26
35	9.7312064	9.9256261	9.8055803	10.1944197	25
36	9.7314040	9.9255454	9.8058587	10.1941413	24
37	9.7316015	9.9254646	9.8061370	10.1938630	23
38	9.7317989	9.9253837	9.8064152	10.1935848	22
39	9.7319961	9.9253028	9.8066933	10.1933067	21
40	9.7321932	9.9252218	9.8069714	10.1930286	20
41	9.7323902	9.9251408	9.8072494	10.1927506	19
42	9.7325870	9.9250597	9.8075273	10.1924727	18
43	9.7327837	9.9249786	9.8078052	10.1921948	17
44	9.7329803	9.9248974	9.8080829	10.1919171	16
45	9.7331768	9.9248161	9.8083606	10.1916394	15
46	9.7333731	9.9247349	9.8086383	10.1913617	14
47	9.7335693	9.9246535	9.8089158	10.1910842	13
48	9.7337654	9.9245721	9.8091933	10.1908067	12
49	9.7339614	9.9244907	9.8094707	10.1905293	11
50	9.7341572	9.9244092	9.8097480	10.1902520	10
51	9.7343529	9.9243277	9.8100253	10.1899747	9
52	9.7345485	9.9242461	9.8103025	10.1896975	8
53	9.7347440	9.9241644	9.8105796	10.1894204	7
54	9.7349393	9.9240827	9.8108566	10.1891434	6
55	9.7351345	9.9240010	9.8111336	10.1888664	5
56	9.7353296	9.9239191	9.8114105	10.1885895	4
57	9.7355246	9.9238373	9.8116873	10.1883127	3
58	9.7357195	9.9237554	9.8119641	10.1880359	2
59	9.7359142	9.9236734	9.8122408	10.1877592	1
60	9.7361088	9.9235914	9.8125174	10.1874826	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	57 Degrees				

Min.	33 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7361088	9.9235914	9.8125174	10.1874826	60
1	9.7363032	9.9235093	9.8127939	10.1872061	59
2	9.7364976	9.9234272	9.8130704	10.1869296	58
3	9.7366918	9.9233450	9.8133468	10.1866532	57
4	9.7368859	9.9232628	9.8136231	10.1863769	56
5	9.7370799	9.9231805	9.8138993	10.1861007	55
6	9.7372737	9.9230982	9.8141755	10.1858245	54
7	9.7374675	9.9230158	9.8144516	10.1855484	53
8	9.7376611	9.9229334	9.8147277	10.1852723	52
9	9.7378546	9.9228509	9.8150036	10.1849964	51
10	9.7380479	9.9227684	9.8152795	10.1847205	50
11	9.7382412	9.9226858	9.8155554	10.1844446	49
12	9.7384343	9.9226032	9.8158311	10.1841689	48
13	9.7386273	9.9225205	9.8161068	10.1838932	47
14	9.7388201	9.9224377	9.8163824	10.1836176	46
15	9.7390129	9.9223549	9.8166580	10.1833420	45
16	9.7392055	9.9222721	9.8169335	10.1830665	44
17	9.7393980	9.9221891	9.8172089	10.1827911	43
18	9.7395904	9.9221062	9.8174842	10.1825158	42
19	9.7397827	9.9220232	9.8177595	10.1822405	41
20	9.7399748	9.9219401	9.8180347	10.1819653	40
21	9.7401668	9.9218570	9.8183098	10.1816902	39
22	9.7403587	9.9217738	9.8185849	10.1814151	38
23	9.7405505	9.9216906	9.8188599	10.1811401	37
24	9.7407421	9.9216073	9.8191348	10.1808652	36
25	9.7409337	9.9215240	9.8194096	10.1805904	35
26	9.7411251	9.9214406	9.8196844	10.1803156	34
27	9.7413164	9.9213572	9.8199592	10.1800408	33
28	9.7415075	9.9212737	9.8202338	10.1797662	32
29	9.7416986	9.9211902	9.8205084	10.1794916	31
30	9.7418895	9.9211066	9.8207829	10.1792171	30
31	9.7420803	9.9210229	9.8210574	10.1789426	29
32	9.7422710	9.9209393	9.8213317	10.1786683	28
33	9.7424616	9.9208555	9.8216060	10.1783940	27
34	9.7426520	9.9207717	9.8218803	10.1781197	26
35	9.7428423	9.9206878	9.8221545	10.1778455	25
36	9.7430325	9.9206039	9.8224286	10.1775714	24
37	9.7432226	9.9205200	9.8227026	10.1772974	23
38	9.7434126	9.9204360	9.8229766	10.1770234	22
39	9.7436024	9.9203519	9.8232505	10.1767495	21
40	9.7437921	9.9202678	9.8235244	10.1764756	20
41	9.7439817	9.9201836	9.8237981	10.1762019	19
42	9.7441712	9.9200994	9.8240719	10.1759281	18
43	9.7443606	9.9200151	9.8243455	10.1756545	17
44	9.7445498	9.9199308	9.8246191	10.1753809	16
45	9.7447390	9.9198464	9.8248926	10.1751074	15
46	9.7449280	9.9197619	9.8251660	10.1748340	14
47	9.7451169	9.9196775	9.8254394	10.1745606	13
48	9.7453056	9.9195929	9.8257127	10.1742873	12
49	9.7454943	9.9195083	9.8259860	10.1740140	11
50	9.7456828	9.9194237	9.8262592	10.1737408	10
51	9.7458712	9.9193390	9.8265323	10.1734677	9
52	9.7460595	9.9192542	9.8268053	10.1731947	8
53	9.7462477	9.9191694	9.8270783	10.1729217	7
54	9.7464358	9.9190845	9.8273513	10.1726487	6
55	9.7466237	9.9189996	9.8276241	10.1723759	5
56	9.7468115	9.9189146	9.8278969	10.1721031	4
57	9.7469992	9.9188296	9.8281696	10.1718304	3
58	9.7471868	9.9187445	9.8284423	10.1715577	2
59	9.7473743	9.9186594	9.8287149	10.1712851	1
60	9.7475617	9.9185742	9.8289874	10.1710126	0
	Sine Comp.	Sine	Tang Comp.	Tang.	Min.
	56 Degrees				

Min.	34 Degrees Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.7475617	9.9185742	9.8289874	10.1710126	60
1	9.7477489	9.9184890	9.8292599	10.1707401	59
2	9.7479360	9.9184037	9.8295323	10.1704677	58
3	9.7481230	9.9183183	9.8298047	10.1701953	57
4	9.7483099	9.9182329	9.8300769	10.1699231	56
5	9.7484967	9.9181475	9.8303492	10.1696508	55
6	9.7486833	9.9180620	9.8306213	10.1693787	54
7	9.7488698	9.9179764	9.8308934	10.1691066	53
8	9.7490562	9.9178908	9.8311654	10.1688346	52
9	9.7492425	9.9178051	9.8314374	10.1685626	51
10	9.7494287	9.9177194	9.8317093	10.1682907	50
11	9.7496148	9.9176336	9.8319811	10.1680189	49
12	9.7498007	9.9175478	9.8322529	10.1677471	48
13	9.7499866	9.9174619	9.8325246	10.1674754	47
14	9.7501723	9.9173760	9.8327963	10.1672037	46
15	9.7503579	9.9172900	9.8330679	10.1669321	45
16	9.7505434	9.9172040	9.8333394	10.1666606	44
17	9.7507287	9.9171179	9.8336109	10.1663891	43
18	9.7509140	9.9170317	9.8338823	10.1661177	42
19	9.7510991	9.9169455	9.8341536	10.1658464	41
20	9.7512842	9.9168593	9.8344249	10.1655751	40
21	9.7514691	9.9167730	9.8346961	10.1653039	39
22	9.7516538	9.9166866	9.8349673	10.1650327	38
23	9.7518385	9.9166002	9.8352384	10.1647616	37
24	9.7520231	9.9165137	9.8355094	10.1644906	36
25	9.7522075	9.9164272	9.8357804	10.1642196	35
26	9.7523919	9.9163406	9.8360513	10.1639487	34
27	9.7525761	9.9162539	9.8363221	10.1636779	33
28	9.7527602	9.9161673	9.8365929	10.1634071	32
29	9.7529442	9.9160805	9.8368636	10.1631364	31
30	9.7431280	9.9159937	9.8371343	10.1628657	30
31	9.7533118	9.9159069	9.8374049	10.1625951	29
32	9.7534954	9.9158200	9.8376755	10.1623245	28
33	9.7536790	9.9157330	9.8379460	10.1620540	27
34	9.7538624	9.9156460	9.8382164	10.1617836	26
35	9.7540457	9.9155589	9.8384867	10.1615133	25
36	9.7542288	9.9154718	9.8387571	10.1612429	24
37	9.7544119	9.9153846	9.8390273	10.1609727	23
38	9.7545949	9.9152974	9.8392975	10.1607025	22
39	9.7547777	9.9152101	9.8395676	10.1604324	21
40	9.7549604	9.9151228	9.8398377	10.1601623	20
41	9.7551431	9.9150354	9.8401077	10.1598923	19
42	9.7553256	9.9149749	9.8403776	10.1596224	18
43	9.7555080	9.9148604	9.8406475	10.1593525	17
44	9.7556902	9.9147729	9.8409174	10.1590826	16
45	9.7558724	9.9146852	9.8411871	10.1588129	15
46	9.7560544	9.9145976	9.8414569	10.1585431	14
47	9.7562364	9.9145099	9.8417265	10.1582735	13
48	9.7564182	9.9144221	9.8419961	10.1580039	12
49	9.7565999	9.9143342	9.8422657	10.1577343	11
50	9.7567815	9.9142464	9.8425351	10.1574649	10
51	9.7569630	9.9141584	9.8428046	10.1571954	9
52	9.7571444	9.9140704	9.8430739	10.1569261	8
53	9.7573256	9.9139824	9.8433432	10.1566568	7
54	9.7575068	9.9138943	9.8436125	10.1563875	6
55	9.7576878	9.9138061	9.8438817	10.1561183	5
56	9.7578687	9.9137179	9.8441508	10.1558492	4
57	9.7580495	9.9136296	9.8444199	10.1555801	3
58	9.7582302	9.9135413	9.8446889	10.1553111	2
59	9.7584108	9.9134530	9.8449579	10.1550421	1
60	9.7585913	9.9133645	9.8452268	10.1547732	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	55 Degrees				

Min.	35 Degrees Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7585913	9.9133645	9.8452268	10.1547732	60
1	9.7587717	9.9132760	9.8454956	10.1545044	59
2	9.7589519	9.9131875	9.8457644	10.1542356	58
3	9.7591321	9.9130989	9.8460332	10.1539668	57
4	9.7593121	9.9130102	9.8463018	10.1536982	56
5	9.7594920	9.9129215	9.8465705	10.1534295	55
6	9.7596718	9.9128328	9.8468390	10.1531610	54
7	9.7598515	9.9127440	9.8471075	10.1538925	53
8	9.7600311	9.9126551	9.8473760	10.1526240	52
9	9.7602106	9.9125662	9.8476444	10.1523556	51
10	9.7603899	9.9124772	9.8479127	10.1520873	50
11	9.7605692	9.9123882	9.8481810	10.1518190	49
12	9.7607483	9.9122991	9.8484492	10.1515508	48
13	9.7609274	9.9122099	9.8487174	10.1512826	47
14	9.7611063	9.9121207	9.8489855	10.1510145	46
15	9.7612851	9.9120315	9.8492536	10.1507464	45
16	9.7614638	9.9119422	9.8495216	10.1504784	44
17	9.7616424	9.9118528	9.8497896	10.1502104	43
18	9.7618208	9.9117634	9.8500575	10.1499425	42
19	9.7619992	9.9116739	9.8503253	10.1496747	41
20	9.7621775	9.9115844	9.8505931	10.1494069	40
21	9.7623556	9.9114948	9.8508608	10.1491392	39
22	9.7625337	9.9114051	9.8511285	10.1488715	38
23	9.7627116	9.9113155	9.8513961	10.1486039	37
24	9.7628894	9.9112257	9.8516637	10.1483363	36
25	9.7630671	9.9111359	9.8519312	10.1480688	35
26	9.7632447	9.9110460	9.8521987	10.1478013	34
27	9.7634222	9.9109561	9.8524661	10.1475339	33
28	9.7635996	9.9108661	9.8527335	10.1472665	32
29	9.7637769	9.9107761	9.8530008	10.1469992	31
30	9.7639540	9.9106860	9.8532680	10.1467320	30
31	9.7641311	9.9105959	9.8535352	10.1464648	29
32	9.7643080	9.9105057	9.8538023	10.1461977	28
33	9.7644849	9.9104155	9.8540694	10.1459306	27
34	9.7646616	9.9103251	9.8543365	10.1456635	26
35	9.7648382	9.9102348	9.8546034	10.1453966	25
36	9.7650147	9.9101444	9.8548704	10.1451296	24
37	9.7651911	9.9100539	9.8551372	10.1448628	23
38	9.7653674	9.9099634	9.8554041	10.1445959	22
39	9.7655436	9.9098728	9.8556708	10.1443292	21
40	9.7657197	9.9097821	9.8559376	10.1440624	20
41	9.7658957	9.9096915	9.8562042	10.1437958	19
42	9.7660715	9.9096007	9.8564708	10.1435292	18
43	9.7662473	9.9095099	9.8567374	10.1432626	17
44	9.7664229	9.9094190	9.8570039	10.1429961	16
45	9.7665985	9.9093281	9.8572704	10.1427296	15
46	9.7667739	9.9092371	9.8575368	10.1424632	14
47	9.7669492	9.9091461	9.8578031	10.1421969	13
48	9.7671244	9.9090550	9.8580694	10.1419306	12
49	9.7672996	9.9089639	9.8583357	10.1416643	11
50	9.7674746	9.9088727	9.8586019	10.1413981	10
51	9.7676494	9.9087814	9.8588680	10.1411320	9
52	9.7678242	9.9086901	9.8591341	10.1408659	8
53	9.7679989	9.9085988	9.8594002	10.1405998	7
54	9.7681735	9.9085073	9.8596661	10.1403339	6
55	9.7683480	9.9084159	9.8599321	10.1400679	5
56	9.7685223	9.9083243	9.8601980	10.1398020	4
57	9.7686966	9.9082327	9.8604638	10.1395362	3
58	9.7688707	9.9081411	9.8607296	10.1392704	2
59	9.7690448	9.9080494	9.8609954	10.1390046	1
60	9.7692187	9.9079576	9.8612610	10.1387390	0
	Sine Comp.	Sine	Tang. Comp	Tang.	Min.
	54 Degrees				

Min.	36 Degrees				
	Sine	Sine Comp	Tang.	Tang. Comp.	
0	9.7692187	9.9079576	9.8612610	10.1387390	60
1	9.7693925	9.9078658	9.8615267	10.1384733	59
2	9.7695662	9.9077740	9.8617923	10.1382077	58
3	9.7697398	9.9076820	9.8620578	10.1379422	57
4	9.7699134	9.9075901	9.8623233	10.1376767	56
5	9.7700868	9.9074980	9.8625887	10.1374113	55
6	9.7702601	9.9074059	9.8628541	10.1371459	54
7	9.7704332	9.9073138	9.8631195	10.1368805	53
8	9.7706063	9.9072216	9.8633848	10.1366152	52
9	9.7707793	9.9071293	9.8636500	10.1363500	51
10	9.7709522	9.9070370	9.8639152	10.1360848	50
11	9.7711249	9.9069446	9.8641803	10.1358197	49
12	9.7712976	9.9068522	9.8644454	10.1355546	48
13	9.7714702	9.9067597	9.8647105	10.1352895	47
14	9.7716426	9.9066671	9.8649755	10.1350245	46
15	9.7718150	9.9065745	9.8652404	10.1347596	45
16	9.7719872	9.9064819	9.8655053	10.1344947	44
17	9.7721593	9.9063892	9.8657702	10.1342298	43
18	9.7723314	9.9062964	9.8660350	10.1339650	42
19	9.7725033	9.9062036	9.8662997	10.1337003	41
20	9.7726751	9.9061107	9.8665644	10.1334356	40
21	9.7728468	9.9060177	9.8668291	10.1331709	39
22	9.7730185	9.9059247	9.8670937	10.1329063	38
23	9.7731900	9.9058317	9.8673583	10.1326417	37
24	9.7733614	9.9057386	9.8676228	10.1323772	36
25	9.7735327	9.9056454	9.8678873	10.1321127	35
26	9.7737039	9.9055522	9.8681517	10.1318483	34
27	9.7738749	9.9054589	9.8684160	10.1315840	33
28	9.7740459	9.9053656	9.8686804	10.1313196	32
29	9.7742168	9.9052722	9.8689446	10.1310554	31
30	9.7743876	9.9051787	9.8692089	10.1307911	30
31	9.7745583	9.9050852	9.8694731	10.1305269	29
32	9.7747288	9.9049916	9.8697372	10.1302628	28
33	9.7748993	9.9048980	9.8700013	10.1299987	27
34	9.7750697	9.9048043	9.8702653	10.1297347	26
35	9.7752399	9.9047106	9.8705293	10.1294707	25
36	9.7754101	9.9046168	9.8707933	10.1292067	24
37	9.7755801	9.9045230	9.8710572	10.1289428	23
38	9.7757501	9.9044291	9.8713210	10.1286790	22
39	9.7759199	9.9043351	9.8715848	10.1284152	21
40	9.7760897	9.9042411	9.8718486	10.1281514	20
41	9.7762593	9.9041470	9.8721123	10.1278877	19
42	9.7764289	9.9040529	9.8723760	10.1276240	18
43	9.7765983	9.9039587	9.8726396	10.1273604	17
44	9.7767676	9.9038644	9.8729032	10.1270968	16
45	9.7769369	9.9037701	9.8731668	10.1268332	15
46	9.7771060	9.9036757	9.8734302	10.1265698	14
47	9.7772750	9.9035813	9.8736937	10.1263063	13
48	9.7774439	9.9034868	9.8739571	10.1260429	12
49	9.7776128	9.9033923	9.8742204	10.1257796	11
50	9.7777815	9.9032977	9.8744838	10.1255162	10
51	9.7779501	9.9032031	9.8747470	10.1252530	9
52	9.7781186	9.9031084	9.8750102	10.1249898	8
53	9.7782870	9.9030136	9.8752734	10.1247266	7
54	9.7784553	9.9029188	9.8755365	10.1244635	6
55	9.7786235	9.9028239	9.8757996	10.1242004	5
56	9.7787916	9.9027289	9.8760627	10.1239373	4
57	9.7789596	9.9026339	9.8763257	10.1236743	3
58	9.7791275	9.9025389	9.8765886	10.1234114	2
59	9.7792953	9.9024438	9.8768515	10.1231485	1
60	9.7794630	9.9023486	9.8771144	10.1228856	0
	Sine Comp	Sine	Tang. Comp.	Tang.	Min.
	53 Degrees				

Min.	37 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7794630	9.9023486	9.8771144	10.1228856	60
1	9.7796306	9.9022534	9.8773772	10.1226228	59
2	9.7797981	9.9021581	9.8776400	10.1223600	58
3	9.7799655	9.9020628	9.8779027	10.1220973	57
4	9.7801328	9.9019674	9.8781654	10.1218346	56
5	9.7803000	9.9018719	9.8784281	10.1215719	55
6	9.7804671	9.9017764	9.8786907	10.1213093	54
7	9.7806341	9.9016808	9.8789533	10.1210467	53
8	9.7808010	9.9015852	9.8792158	10.1207842	52
9	9.7809677	9.9014895	9.8794782	10.1205218	51
10	9.7811344	9.9013938	9.8797407	10.1202593	50
11	9.7813010	9.9012980	9.8800031	10.1199969	49
12	9.7814675	9.9012021	9.8802654	10.1197346	48
13	9.7816339	9.9011062	9.8805277	10.1194723	47
14	9.7818002	9.9010102	9.8807900	10.1192100	46
15	9.7819664	9.9009142	9.8810522	10.1189478	45
16	9.7821324	9.9008181	9.8813144	10.1186856	44
17	9.7822984	9.9007219	9.8815765	10.1184235	43
18	9.7824643	9.9006257	9.8818386	10.1181614	42
19	9.7826301	9.9005294	9.8821007	10.1178993	41
20	9.7827958	9.9004331	9.8823627	10.1176373	40
21	9.7829614	9.9003367	9.8826246	10.1173754	39
22	9.7831268	9.9002403	9.8828866	10.1171134	38
23	9.7832922	9.9001438	9.8831484	10.1168516	37
24	9.7834575	9.9000472	9.8834103	10.1165897	36
25	9.7836227	9.8999506	9.8836721	10.1163279	35
26	9.7837878	9.8998539	9.8839338	10.1160662	34
27	9.7839528	9.8997572	9.8841956	10.1158044	33
28	9.7841177	9.8996604	9.8844572	10.1155428	32
29	9.7842824	9.8995636	9.8847189	10.1152811	31
30	9.7844471	9.8994667	9.8849805	10.1150195	30
31	9.7846117	9.8993697	9.8852420	10.1147580	29
32	9.7847762	9.8992727	9.8855035	10.1144965	28
33	9.7849406	9.8991756	9.8857650	10.1142350	27
34	9.7851049	9.8990784	9.8860264	10.1139736	26
35	9.7852691	9.8989812	9.8862878	10.1137122	25
36	9.7854332	9.8988840	9.8865492	10.1134508	24
37	9.7855972	9.8987867	9.8868105	10.1131895	23
38	9.7857611	9.8986893	9.8870718	10.1129282	22
39	9.7859249	9.8985919	9.8873330	10.1126670	21
40	9.7860886	9.8984944	9.8875942	10.1124058	20
41	9.7862522	9.8983968	9.8878554	10.1121446	19
42	9.7864157	9.8982992	9.8881165	10.1118835	18
43	9.7865791	9.8982015	9.8883775	10.1116225	17
44	9.7867424	9.8981038	9.8886386	10.1113614	16
45	9.7869056	9.8980060	9.8888996	10.1111004	15
46	9.7870687	9.8979082	9.8891605	10.1108395	14
47	9.7872317	9.8978103	9.8894214	10.1105786	13
48	9.7873946	9.8977123	9.8896823	10.1103177	12
49	9.7875574	9.8976143	9.8899432	10.1100568	11
50	9.7877202	9.8975162	9.8902040	10.1097960	10
51	9.7878828	9.8974181	9.8904647	10.1095353	9
52	9.7880453	9.8973199	9.8907254	10.1092746	8
53	9.7882077	9.8972216	9.8909861	10.1090139	7
54	9.7883701	9.8971233	9.8912468	10.1087532	6
55	9.7885323	9.8970249	9.8915074	10.1084926	5
56	9.7886944	9.8969265	9.8917679	10.1082321	4
57	9.7888565	9.8968280	9.8920285	10.1079715	3
58	9.7890184	9.8967294	9.8922890	10.1077110	2
59	9.7891802	9.8966308	9.8925494	10.1074506	1
60	9.7893420	9.8965321	9.8928098	10.1071902	0
	Sine Comp.	Sine	Tang. Comp	Tang.	Min.
	52 Degrees				

Min.	38 Degrees. Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7893420	9.8965321	9.8928098	10.1071902	60
1	9.7895036	9.8964334	9.8930702	10.1069295	59
2	9.7896652	9.8963346	9.8933306	10.1066694	58
3	9.7898266	9.8962358	9.8935909	10.1064091	57
4	9.7899880	9.8961369	9.8938511	10.1061489	56
5	9.7901493	9.8960379	9.8941114	10.1058886	55
6	9.7903104	9.8959389	9.8943715	10.1056285	54
7	9.7904715	9.8958398	9.8946317	10.1053683	53
8	9.7906325	9.8957406	9.8948918	10.1051082	52
9	9.7907933	9.8956414	9.8951519	10.1048481	51
10	9.7909541	9.8955422	9.8954119	10.1045881	50
11	9.7911148	9.8954429	9.8956719	10.1043281	49
12	9.7912754	9.8953435	9.8959319	10.1040681	48
13	9.7914359	9.8952440	9.8961918	10.1038082	47
14	9.7915963	9.8951445	9.8964517	10.1035483	46
15	9.7917566	9.8950450	9.8967116	10.1032884	45
16	9.7919168	9.8949453	9.8969714	10.1030286	44
17	9.7920769	9.8948457	9.8972312	10.1027688	43
18	9.7922369	9.8947459	9.8974910	10.1025090	42
19	9.7923968	9.8946461	9.8977507	10.1022493	41
20	9.7925566	9.8945463	9.8980104	10.1019896	40
21	9.7927163	9.8944463	9.8982700	10.1017300	39
22	9.7928760	9.8943464	9.8985296	10.1014704	38
23	9.7930355	9.8942463	9.8987892	10.1012108	37
24	9.7931949	9.8941462	9.8990487	10.1009513	36
25	9.7933543	9.8940461	9.8993082	10.1006918	35
26	9.7935135	9.8939458	9.8995677	10.1004323	34
27	9.7936727	9.8938456	9.8998271	10.1001729	33
28	9.7938317	9.8937452	9.9000865	10.0999135	32
29	9.7939907	9.8936448	9.9003459	10.0996541	31
30	9.7941496	9.8935444	9.9006052	10.0993948	30
31	9.7943083	9.8934439	6.9008645	10.0991355	29
32	9.7944670	9.8933433	9.9011237	10.0988763	28
33	9.7946256	9.8932426	9.9013830	10.0986170	27
34	9.7947841	9.8931419	9.9016422	10.0983578	26
35	9.7949425	9.8930412	9.9019013	10.0980987	25
36	9.7951008	9.8929404	9.9021604	10.0978396	24
37	9.7952590	9.8928395	9.9024195	10.0975805	23
38	9.7954171	9.8927385	9.9026786	10.0973214	22
39	9.7955751	9.8926375	9.9029376	10.0970624	21
40	9.7957330	9.8925365	9.9031966	10.0968034	20
41	9.7958909	9.8924354	9.9034555	10.0965445	19
42	9.7960486	9.8923342	9.9037144	10.0962856	18
43	9.7962062	9.8922329	9.9039733	10.0960267	17
44	9.7963638	9.8921316	9.9042321	10.0957679	16
45	9.7965212	9.8920303	9.9044910	10.0955090	15
46	9.7966786	9.8919289	9.9047497	10.0952503	14
47	9.7968359	9.8918274	9.9050085	10.0949915	13
48	9.7969930	9.8917258	9.9052672	10.0947328	12
49	9.7971501	9.8916242	9.9055259	10.0944741	11
50	9.7973071	9.8915226	9.9057845	10.0942155	10
51	9.7974640	9.8914208	9.9060431	10.0939569	9
52	9.7976208	9.8913191	9.9063017	10.0936983	8
53	9.7977775	9.8912172	9.9065603	10.0934397	7
54	9.7979341	9.8911153	9.9068188	10.0931812	6
55	9.7980906	9.8910133	9.9070773	10.0929227	5
56	9.7982470	9.8909113	9.9073357	10.0926643	4
57	9.7984034	9.8908092	9.9075941	10.0924059	3
58	9.7985596	9.8907071	9.9078525	10.0921475	2
59	9.7987158	9.8906049	9.9081109	10.0918891	1
60	9.7988718	9.8905026	9.9083692	10.0916308	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	51 Degrees				

Min.	39 Degrees. Sine	Sine Comp.	Tang.	Tang. Com.	
0	9.7988718	9.8905026	9.9083692	10.0916308	60
1	9.7990278	9.8904003	9.9086275	10.0913725	59
2	9.7991836	9.8902979	9.9088858	10.0911142	58
3	9.7993394	9.8901954	9.9091440	10.0908560	57
4	9.7994951	9.8900929	9.9094022	10.0905978	56
5	9.7996507	9.8899903	9.9096603	10.0903397	55
6	9.7998062	9.8898877	9.9099185	10.0900815	54
7	9.7999616	9.8897850	9.9101766	10.0898234	53
8	9.8001169	9.8896822	9.9104347	10.0895653	52
9	9.8002721	9.8895794	9.9106927	10.0893073	51
10	9.8004272	9.8894765	9.9109507	10.0890493	50
11	9.8005823	9.8893736	9.9112087	10.0887913	49
12	9.8007372	9.8892706	9.9114666	10.0885334	48
13	9.8008921	9.8891675	9.9117245	10.0882755	47
14	9.8010468	9.8890644	9.9119824	10.0880176	46
15	9.8012015	9.8889612	9.9122403	10.0877597	45
16	9.8013561	9.8888580	9.9124981	10.0875019	44
17	9.8015106	9.8887547	9.9127559	10.0872441	43
18	9.8016649	9.8886513	9.9130137	10.0869863	42
19	9.8018192	6.8885479	9.9132714	10.0867286	41
20	9.8019735	9.8884444	9.9135291	10.0864709	40
21	9.8021276	9.8883408	9.9137868	10.0862132	39
22	9.8022816	9.8882372	9.9140444	10.0859556	38
23	9.8024355	9.8881335	9.9143020	10.0856980	37
24	9.8025894	9.8880298	9.9145596	10.0854404	36
25	9.8027431	9.8879260	9.9148171	10.0851829	35
26	9.8028968	9.8878221	9.9150747	10.0849253	34
27	9.8030504	9.8877182	9.9153322	10.0846678	33
28	9.8032038	9.8876142	9.9155896	10.0844104	32
29	9.8033572	9.8875102	9.9158471	10.0841529	31
30	9.8035105	9.8874061	9.9161045	10.0838955	30
31	9.8036637	9.8873019	9.9163618	10.0836382	29
32	9.8038168	9.8871977	9.9166192	10.0833808	28
33	9.8039699	9.8870934	9.9168765	10.0831235	27
34	9.8041228	9.8869890	9.9171338	10.0828662	26
35	9.8042757	9.8868846	9.9173911	10.0826089	25
36	9.8044284	9.8867801	9.9176483	10.0823517	24
37	9.8045811	9.8866756	9.9179055	10.0820945	23
38	9.8047336	9.8865710	9.9181627	10.0818373	22
39	9.8048861	9.8864663	9.9184198	10.0815802	21
40	9.8050385	9.8863616	9.9186769	10.0813231	20
41	9.8051908	9.8862568	9.9189340	10.0810660	19
42	9.8053430	9.8861519	9.9191911	10.0808089	18
43	9.8054951	9.8860470	9.9194481	10.0805519	17
44	9.8056472	9.8859420	9.9197051	10.0802949	16
45	9.8057991	9.8858370	9.9199621	10.0800379	15
46	9.8059510	9.8857319	9.9202191	10.0797809	14
47	9.8061027	9.8856267	9.9204760	10.0795240	13
48	9.8062544	9.8855215	9.9207329	10.0792671	12
49	9.8064060	9.8854162	9.9209898	10.0790102	11
50	9.8065575	9.8853109	9.9212466	10.0787534	10
51	9.8067089	9.8852055	9.9215034	10.0784966	9
52	9.8068602	9.8851000	9.9217602	10.0782398	8
53	9.8070114	9.8849945	9.9220170	10.0779830	7
54	9.8071626	9.8848889	9.9222737	10.0777263	6
55	9.8073136	9.8847832	9.9225304	10.0774696	5
56	9.8074646	9.8846775	9.9227871	10.0772129	4
57	9.8076154	9.8845717	9.9230437	10.0769563	3
58	9.8077662	9.8844659	9.9233004	10.0766996	2
59	9.8079169	9.8843599	9.9235570	10.0764430	1
60	9.8080675	9.8842540	9.9238135	10.0761865	0
	Sine Comp.	Sine.	Tang Comp.	Tang.	Min.
	50 Degrees				

Min.	40 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.8080675	9.8842540	9.9238135	10.0761805	60
1	9.8082180	9.8841479	9.9240701	10.0759299	59
2	9.8083684	9.8840418	9.9243266	10.0756734	58
3	9.8085188	9.8839357	9.9245831	10.0754169	57
4	9.8086690	9.8838294	9.9248396	10.0751604	56
5	9.8088192	9.8837232	9.9250960	10.0749040	55
6	9.8089692	9.8836168	9.9253524	10.0746476	54
7	9.8091192	9.8835104	9.9256088	10.0743912	53
8	9.8092691	9.8834039	9.9258652	10.0741348	52
9	9.8094189	9.8832974	9.9261215	10.0738785	51
10	9.8095686	9.8831908	9.9263778	10.0736222	50
11	9.8097182	9.8830841	9.9266341	10.0733659	49
12	9.8098678	9.8829774	9.9268904	10.0731096	48
13	9.8100172	9.8828706	9.9271466	10.0728534	47
14	9.8101666	9.8827638	9.9274028	10.0725972	46
15	9.8103159	9.8826568	9.9276590	10.0723410	45
16	9.8104650	9.8825499	9.9279152	10.0720848	44
17	9.8106141	9.8824428	9.9281713	10.0718287	43
18	9.8107631	9.8823357	9.9284274	10.0715720	42
19	9.8109121	9.8822285	9.9286835	10.0713165	41
20	9.9110609	9.8821213	9.9289396	10.0710604	40
21	9.8112096	9.8820140	9.9291956	10.0708044	39
22	9.8113583	9.8819067	9.9294516	10.0705484	38
23	9.8115069	9.8817992	9.9297076	10.0702924	37
24	9.8116554	9.8816918	9.9299636	10.0700364	36
25	9.8118038	9.8815842	9.9302195	10.0697805	35
26	9.8119521	9.8814766	9.9304755	10.0695245	34
27	9.8121003	9.8813689	9.9307314	10.0692686	33
28	9.8122484	9.8812612	9.9309872	10.0690128	32
29	9.8123965	9.8811534	9.9312431	10.0687569	31
30	9.8125444	9.8810455	9.9314989	10.0685011	30
31	9.8126923	9.8809376	9.9317547	10.0682453	29
32	9.8128401	9.8808296	9.9320105	10.0679895	28
33	9.8129878	9.8807215	9.9322662	10.0677338	27
34	9.8131354	9.8806134	9.9325220	10.0674780	26
35	9.8132829	9.8805052	9.9327777	10.0672223	25
36	9.8134303	9.8803970	9.9330334	10.0669666	24
37	9.8135777	9.8802887	9.9333890	10.0667110	23
38	9.8137250	9.8801803	9.9335446	10.0664554	22
39	9.8138721	9.8800719	9.9338003	10.0661997	21
40	9.8140192	9.8799634	9.9340559	10.0659441	20
41	9.8141662	9.8798548	9.9343114	10.0656886	19
42	9.8143131	9.8797462	9.9345670	10.0654330	18
43	9.8144600	9.8796375	9.9348225	10.0651775	17
44	9.8146067	9.8795287	9.9350780	10.0649220	16
45	9.8147534	9.8794199	9.9353335	10.0646665	15
46	9.8148999	9.8793110	9.9355889	10.0644111	14
47	9.8150464	9.8792021	9.9358444	10.0641556	13
48	9.8151928	9.8790930	9.9360998	10.0639002	12
49	9.8153391	9.8789840	9.9363552	10.0636448	11
50	9.8154854	9.8788748	9.9366105	10.0633895	10
51	9.8156315	9.8787656	9.9368659	10.0631341	9
52	9.8157776	9.8786563	9.9371212	10.0628788	8
53	9.8159235	9.8785470	9.9373765	10.0626235	7
54	9.8160694	9.8784376	9.9376318	10.0623682	6
55	9.8162152	9.8783281	9.9378871	10.0621129	5
56	9.8163609	9.8782186	9.9381423	10.0618577	4
57	9.8165066	9.8781090	9.9383975	10.0616025	3
58	9.8166521	9.8779994	9.9386527	10.0613473	2
59	9.8167975	9.8778896	9.9389079	10.0610921	1
60	9.8169429	9.8777799	9.9391631	10.0608369	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	49 Degrees				

Min.	41 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.8169429	9.8777799	9.9391631	10.0608369	60
1	9.8170882	9.8776700	9.9394182	10.0605818	59
2	9.8172334	9.8775601	9.9396733	10.0603267	58
3	9.8173785	9.8774501	9.9399284	10.0600716	57
4	9.8175235	9.8773401	9.9401835	10.0598165	56
5	9.8176685	9.8772300	9.9404386	10.0595615	55
6	9.8178133	9.8771198	9.9406936	10.0593064	54
7	9.8179581	9.8770096	9.9409486	10.0590514	53
8	9.8181028	9.8768993	9.9412036	10.0587964	52
9	9.8182474	9.8767889	9.9414585	10.0585415	51
10	9.8183919	9.8766785	9.9417135	10.0582865	50
11	9.8185364	9.8765680	9.9419684	10.0580316	49
12	9.8186807	9.8764574	9.9422233	10.0577767	48
13	9.8188250	9.8763468	9.9424782	10.0575218	47
14	9.8189692	9.8762361	9.9427331	10.0572669	46
15	9.8191133	9.8761253	9.9429879	10.0570121	45
16	9.8192573	9.8760145	9.9432428	10.0567572	44
17	9.8194012	9.8759036	9.9434976	10.0565024	43
18	9.8195450	9.8757927	9.9437524	10.0562476	42
19	9.8196888	9.8756816	9.9440072	10.0559928	41
20	9.8198325	9.8755706	9.9442619	10.0557381	40
21	9.8199761	9.8754594	9.9445166	10.0554834	39
22	9.8201196	9.8753482	9.9447714	10.0552286	38
23	9.8202630	9.8752369	9.9450261	10.0549739	37
24	9.8204063	9.8751256	9.9452807	10.0547193	36
25	9.8205496	9.8750142	9.9455354	10.0544646	35
26	9.8206927	9.8749027	9.9457900	10.0542100	34
27	9.8208358	9.8747912	9.9460447	10.0539553	33
28	9.8209788	9.8746795	9.9462993	10.0537007	32
29	9.8211217	9.8745679	9.9465539	10.0534461	31
30	9.8212646	9.8744561	9.9468085	10.0531916	30
31	9.8214073	9.8743443	9.9470630	10.0529370	29
32	9.8215500	9.8742325	9.9473175	10.0526825	28
33	9.8216926	9.8741205	9.9475721	10.0524280	27
34	9.8218351	9.8740085	9.9478265	10.0521735	26
35	9.8219775	9.8738965	9.9480810	10.0519190	25
36	9.8221198	9.8737844	9.9483355	10.0516645	24
37	9.8222621	9.8736722	9.9485899	10.0514101	23
38	9.8224042	9.8735599	9.9488443	10.0511557	22
39	9.8225463	9.8734476	9.9490987	10.0509013	21
40	9.8226883	9.8733352	9.9493531	10.0506469	20
41	9.8228302	9.8732227	9.9496075	10.0503925	19
42	9.8229721	9.8731102	9.9498619	10.0501381	18
43	9.8231138	9.8729976	9.9501162	10.0498838	17
44	9.8232555	9.8728849	9.9503705	10.0496295	16
45	9.8233971	9.8727722	9.9506248	10.0493752	15
46	9.8235386	9.8726594	9.9508791	10.0491209	14
47	9.8236800	9.8725466	9.9511334	10.0488666	13
48	9.8238213	9.8724337	9.9513876	10.0486124	12
49	9.8239626	9.8723207	9.9516419	10.0483581	11
50	9.8241037	9.8722076	9.9518961	10.0481039	10
51	9.8242448	9.8720945	9.9521503	10.0478497	9
52	9.8243858	9.8719813	9.9524045	10.0475955	8
53	9.8245267	9.8718681	9.9526587	10.0473413	7
54	9.8246676	9.8717548	9.9529128	10.0470872	6
55	9.8248083	9.8716414	9.9531670	10.0468330	5
56	9.8249490	9.8715279	9.9534211	10.0465789	4
57	9.8250896	9.8714144	9.9536752	10.0463248	3
58	9.8252301	9.8713008	9.9539293	10.0460707	2
59	9.8253705	9.8711872	9.9541834	10.0458166	1
60	9.8255109	9.8710735	9.9544374	10.0455626	0
	Sine Comp.	Sine	Tang Comp.	Tang.	Min.
	48 Degrees				

Min.	42 Degrees				
	Sine.	Sine Comp.	Tang.	Tang. Comp.	
0	9.8255109	9.8710735	9.9544374	10.0455626	60
1	9.8256512	9.8709597	9.9546915	10.0453085	59
2	9.8257913	9.8708458	9.9549455	10.0450545	58
3	9.8259314	9.8707319	9.9551995	10.0448005	57
4	9.8260715	9.8706179	9.9554535	10.0445465	56
5	9.8262114	9.8705039	9.9557075	10.0442925	55
6	9.8263512	9.8703898	9.9559615	10.0440385	54
7	9.8264910	9.8702756	9.9562154	10.0437846	53
8	9.8266307	9.8701613	9.9564964	10.0435306	52
9	9.8267703	9.8700470	9.9567233	10.0432767	51
10	9.8269098	9.8699326	9.9569772	10.0430228	50
11	9.8270493	9.8698182	9.9572311	10.0427689	49
12	9.8271887	9.8697037	9.9574850	10.0425150	48
13	9.8273279	9.8695891	9.9577389	10.0422611	47
14	9.8274671	9.8694744	9.9579927	10.0420073	46
15	9.8276063	9.8693597	9.9582465	10.0417535	45
16	9.8277453	9.8692449	9.9585004	10.0414996	44
17	9.8278843	9.8691301	9.9587542	10.0412458	43
18	9.8280231	9.8690152	9.9590080	10.0409920	42
19	9.8281619	9.8689002	9.9592618	10.0407382	41
20	9.8283006	9.8687851	9.9595155	10.0404845	40
21	9.8284393	9.8686700	9.9597693	10.0402307	39
22	9.8285778	9.8685548	9.9600230	10.0399770	38
23	9.8287163	9.8684396	9.9602767	10.0397233	37
24	9.8288547	9.8683242	9.9605305	10.0394695	36
25	9.8289930	9.8682088	9.9607842	10.0392158	35
26	9.8291312	9.8680934	9.9610378	10.0389622	34
27	9.8292694	9.8679779	9.9612915	10.0387085	33
28	9.8294075	9.8678623	9.9615452	10.0384548	32
29	9.8295454	9.8677466	9.9617988	10.0382012	31
30	9.8296833	9.8676309	9.9620525	10.0379475	30
31	9.8298212	9.8675151	9.9623061	10.0376939	29
32	9.8299589	9.8673992	9.9625597	10.0374403	28
33	9.8300966	9.8672833	9.9628133	10.0371867	27
34	9.8302342	9.8671673	9.9630669	10.0369331	26
35	9.8303717	9.8670512	9.9633204	10.0366796	25
36	9.8305091	9.8669351	9.9635740	10.0364260	24
37	9.8306464	9.8668189	9.9638275	10.0361725	23
38	9.8307837	9.8667026	9.9640811	10.0359189	22
39	9.8309209	9.8665863	9.9643346	10.0356654	21
40	9.8310580	9.8664699	9.9645881	10.0354119	20
41	9.8311950	9.8663534	9.9648416	10.0351584	19
42	9.8313320	9.8662369	9.9650951	10.0349049	18
43	9.8314688	9.8661203	9.9653486	10.0346514	17
44	9.8316056	9.8660036	9.9656020	10.0343980	16
45	9.8317423	9.8658868	9.9658555	10.0341445	15
46	9.8318789	9.8657700	9.9661089	10.0338911	14
47	9.8320155	9.8656531	9.9663623	10.0336377	13
48	9.8321519	9.8655362	9.9666157	10.0333843	12
49	9.8322883	9.8654192	9.9668692	10.0331308	11
50	9.8324246	9.8653021	9.9671225	10.0328775	10
51	9.8325609	9.8651849	9.9673759	10.0326241	9
52	9.8326970	9.8650677	9.9676293	10.0323707	8
53	9.8328331	9.8649504	9.9678827	10.0321173	7
54	9.8329691	9.8648331	9.9681360	10.0318640	6
55	9.8331050	9.8647156	9.9683893	10.0316107	5
56	9.8332408	9.8645981	9.9686427	10.0313573	4
57	9.8333766	9.8644806	9.9688960	10.0311040	3
58	9.8335122	9.8643629	9.9691493	10.0308507	2
59	9.8336478	9.8642452	9.9694026	10.0305974	1
60	9.8337833	9.8641275	9.9696559	10.0303441	0
	Sine Comp	Sine	Tang. Comp.	Tang.	Min.
	47 Degrees				

Min.	43 Degrees				
	Sine	Sine Comp	Tang.	Tang. Comp.	
0	9.8337833	9.8641275	9.9696559	10.0303441	60
1	9.8339188	9.8640096	9.9699091	10.0300909	59
2	9.8340541	9.8638917	9.9701624	10.0298376	58
3	9.8341894	9.8637737	9.9704157	10.0295843	57
4	9.8343246	9.8636557	9.9706689	10.0293311	56
5	9.8344597	9.8635376	9.9709221	10.0290779	55
6	9.8345948	9.8634194	9.9711754	10.0288246	54
7	9.8347297	9.8633011	9.9714286	10.0285714	53
8	9.8348646	9.8631828	9.9716818	10.0283182	52
9	9.8349994	9.8630644	9.9719350	10.0280650	51
10	9.8351341	9.8629460	9.9721882	10.0278118	50
11	9.8352688	9.8628274	9.9724413	10.0275587	49
12	9.8354033	9.8627088	9.9726945	10.0273055	48
13	9.8355378	9.8625902	9.9729477	10.0270523	47
14	9.8356722	9.8624714	9.9732008	10.0267992	46
15	9.8358066	9.8623526	9.9734539	10.0265461	45
16	9.8359408	9.8622338	9.9737071	10.0262929	44
17	9.8360750	9.8621148	9.9739602	10.0260398	43
18	9.8362091	9.8619958	9.9742133	10.0257867	42
19	9.8363431	9.8618767	9.9744664	10.0255336	41
20	9.8364771	9.8617576	9.9747195	10.0252805	40
21	9.8366109	9.8616383	9.9749726	10.0250274	39
22	9.8367447	9.8615190	9.9752257	10.0247743	38
23	9.8368784	9.8613997	9.9754787	10.0245213	37
24	9.8370121	9.8612803	9.9757318	10.0242682	36
25	9.8371456	9.8611608	9.9759849	10.0240151	35
26	9.8372791	9.8610412	9.9762379	10.0237621	34
27	9.8374125	9.8609215	9.9764909	10.0235091	33
28	9.8375458	9.8608018	9.9767440	10.0232560	32
29	9.8376790	9.8606821	9.9769970	10.0230030	31
30	9.8378122	9.8605622	9.9772500	10.0227500	30
31	9.8379453	9.8604423	9.9775030	10.0224970	29
32	9.8380783	9.8603223	9.9777560	10.0222440	28
33	9.8382112	9.8602022	9.9780090	10.0219910	27
34	9.8383441	9.8600821	9.9782620	10.0217380	26
35	9.8384769	9.8599619	9.9785149	10.0214851	25
36	9.8386096	9.8598416	9.9787679	10.0212321	24
37	9.8387422	9.8597213	9.9790209	10.0209791	23
38	9.8388747	9.8596009	9.9792738	10.0207262	22
39	9.8390072	9.8594804	9.9795268	10.0204732	21
40	9.8391396	9.8593599	9.9797797	10.0202203	20
41	9.8392719	9.8592393	9.9800326	10.0199674	19
42	9.8394041	9.8591186	9.9802856	10.0197144	18
43	9.8395363	9.8589978	9.9805385	10.0194615	17
44	9.8396684	9.8588770	9.9807914	10.0192086	16
45	9.8398004	9.8587561	9.9810443	10.0189557	15
46	9.8399323	9.8586351	9.9812972	10.0187028	14
47	9.8400642	9.8585141	9.9815501	10.0184499	13
48	9.8401959	9.8583929	9.9818030	10.0181970	12
49	9.8403276	9.8582718	9.9820559	10.0179441	11
50	9.8404593	9.8581505	9.9823087	10.0176913	10
51	9.8405908	9.8580292	9.9825616	10.0174384	9
52	9.8407223	9.8579078	9.9828145	10.0171855	8
53	9.8408537	9.8577863	9.9830673	10.0169327	7
54	9.8409850	9.8576648	9.9833202	10.0166798	6
55	9.8411162	9.8575432	9.9835730	10.0164270	5
56	9.8412474	9.8574215	9.9838259	10.0161741	4
57	9.8413785	9.8572998	9.9840787	10.0159213	3
58	9.8415095	9.8571779	9.9843315	10.0156685	2
59	9.8416404	9.8570561	9.9845844	10.0154156	1
60	9.8417713	9.8569341	9.9848372	10.0151628	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	46 Degrees				

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
	44 Degrees				
0	9.8417713	9.8569349	9.9848372	10.0151628	60
1	9.8419021	9.8568121	9.9850900	10.0149100	59
2	9.8420328	9.8566900	9.9853428	10.0146752	58
3	9.8421634	9.8565678	9.9855956	10.0144044	57
4	9.8422939	9.8564455	9.9858484	10.0141516	56
5	9.8424244	9.8563232	9.9861012	10.0138988	55
6	9.8425548	9.8562008	9.9863540	10.0136460	54
7	9.8426851	9.8560784	9.9866068	10.0133932	53
8	9.8428154	9.8559558	9.9868596	10.0131404	52
9	9.8429456	9.8558332	9.9871123	10.0128877	51
10	9.8430757	9.8557106	9.9873651	10.0126349	50
11	9.8432057	9.8555878	9.9876179	10.0123821	49
12	9.8433356	9.8554650	9.9878706	10.0121294	48
13	9.8434655	9.8553421	9.9881234	10.0118766	47
14	9.8435953	9.8552192	9.9883761	10.0116239	46
15	9.8437250	9.8550961	9.9886289	10.0113711	45
16	9.8438547	9.8549730	9.9888816	10.0111184	44
17	9.8439842	9.8548499	9.9891344	10.0108656	43
18	9.8441137	9.8547266	9.9893871	10.0106129	42
19	9.8442423	9.8546033	9.9896399	10.0103601	41
20	9.8443725	9.8544799	9.9898926	10.0101074	40
21	9.8445018	9.8543564	9.9901453	10.0098547	39
22	9.8446310	9.8542329	9.9903981	10.0096019	38
23	9.8447601	9.8541093	9.9906508	10.0093492	37
24	9.8448891	9.8539856	9.9909035	10.0090965	36
25	9.8450181	9.8538619	9.9911562	10.0088438	35
26	9.8451470	9.8537381	9.9914089	10.0085911	34
27	9.8452758	9.8536142	9.9916616	10.0083384	33
28	9.8454045	9.8534902	9.9919143	10.0080857	32
29	9.8455332	9.8533662	9.9921670	10.0078330	31
30	9.8456618	9.8532421	9.9924197	10.0075803	30
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	45 Degrees				

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
	44 Degrees				
30	9.8456618	9.8532421	9.9924197	10.0075803	30
31	9.8457903	9.8531179	9.9926724	10.0073276	29
32	9.8459188	9.8529936	9.9929251	10.0070749	28
33	9.8460471	9.8528693	9.9931778	10.0068222	27
34	9.8461754	9.8527449	9.9934305	10.0065695	26
35	9.8463036	9.8526204	9.9936832	10.0063168	25
36	9.8464318	9.8524959	9.9939359	10.0060641	24
37	9.8465599	9.8523713	9.9941886	10.0058114	23
38	9.8466879	9.8522466	9.9944413	10.0055587	22
39	9.8468158	9.8521218	9.9946940	10.0053060	21
40	9.8469436	9.8519970	9.9949466	10.0050534	20
41	9.8470714	9.8518721	9.9951993	10.0048007	19
42	9.8471991	9.8517471	9.9954520	10.0045480	18
43	9.8473267	9.8516220	9.9957047	10.0042953	17
44	9.8474543	9.8514969	9.9959573	10.0040427	16
45	9.8475817	9.8513717	9.9962100	10.0037900	15
46	9.8477091	9.8512465	9.9964627	10.0035373	14
47	9.8478365	9.8511211	9.9967154	10.0032846	13
48	9.8479637	9.8509957	9.9969680	10.0030320	12
49	9.8480909	9.8508702	9.9972207	10.0025793	11
50	9.8482180	9.8507446	9.9974734	10.0022266	10
51	9.8483450	9.8506190	9.9977260	10.0022740	9
52	9.8484720	9.8504933	9.9979787	10.0020213	8
53	9.8485989	9.8503675	9 9982314	10.0017686	7
54	9.8487257	9.8502417	9.9984840	10.0015160	6
55	9.8488524	9.8501157	9.9987367	10.0012633	5
56	9.8489791	9.8499897	9.9989893	10.0010107	4
57	9.8491057	9.8498637	9.9992420	10.0007580	3
58	9.8492322	9.8497375	9.9994947	10.0005053	2
59	9.8493586	9.8496113	9.9997473	10.0002527	1
60	9.8494850	9.8494850	10.0000000	10.0000000	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.
	45 Degrees				

Logarithmic curve.

Plate CCLXXII fig. 3.

LOGARITHMIC CURVE. If on the line A N both ways indefinitely extended, be taken A C, C E, E G, G I, I L, on the right hand; and alſo A *g*, *g* P, &c, on the left, all equal to one another: and if at the points P *g*, A, C, E, G, I, L, be erected to the right line A N, the perpendiculars P S, *g d*, A B, C D, E F, G H, I K, L M, which let be continually proportional, and repreſent numbers, viz. AB, 1; CD, 10; EF, 100, &c. then ſhall we have two progreſſions of lines, arithmetical and geometrical: for the lines AC, AE, AG, &c. are in arithmetical progreſſion, or as 1, 2, 3, 4, 5, &c. and ſo repreſent the logarithms to which the geometrical lines A B, C D, E F, &c. do correſpond. For ſince AG is triple of the firſt line AC, the number GH ſhall be in the third place from unity, if C D be in the firſt: ſo likewiſe ſhall L M be in the fifth place, ſince A L = 5 AC. If the extremities of the proportionals S, *d*, B, D, F, &c. be joined by right lines, the figures S B M L will become a polygon, conſiſting of more or leſs ſides, according as there are more or leſs terms in the progreſſion.

If the parts A C, C E, E G, &c. be biſected in the points *c*, *e*, *g*, *i*, *l*, and there be again raiſed the perpendiculars, *c d*, *e f*, *g h*, *i k*, *l m*, which are mean proportionals between A B, C D, C D, E F, &c. then there will ariſe a new ſeries of proportionals, whoſe terms, beginning from that which immediately follows unity, are double of thoſe in the firſt ſeries, and the difference of the terms is become leſs, and approach nearer to a ratio of equality than before. Likewiſe, in this new ſeries, the right lines A L, A *e*, expreſs the diſtances of the terms L M *ed*, from unity, viz. ſince A L is ten times greater than A *e*, L M ſhall be the tenth term of the ſeries from unity: and becauſe A *e* is three times greater than A *c*, *e f* will be the third term of the ſeries if *c d* be the firſt, and there ſhall be two mean proportionals between A B and *e f*, and between A B and L M there will be nine mean proportionals. And if the extremities of the lines B *d*, D *f*, F *h*, &c. be joined by right lines, there will be a new polygon made, conſiſting of more but ſhorter ſides than the laſt.

Logarithmic curve.

If, in this manner, mean proportionals be continually placed between every two terms, the number of terms at laſt will be made ſo great, as alſo the number of the ſides of the polygon, as to be greater than any given number, or to be infinite; and every ſide of the polygon ſo leſſened, as to become leſs than any given right line; and conſequently the polygon will be changed into a curve-lined figure; for any curve-lined figure may be conceived as a polygon, whoſe ſides are infinitely ſmall and infinite in number. A curve deſcribed after this manner is called *logarithmical*.

It is manifeſt from this deſcription of the logarithmic curve, that all numbers at equal diſtances are con-

Logarithmic Lines.

tinually proportional. It is alſo plain, that if there be four numbers, AB, CD, IK, LM, ſuch that the diſtance between the firſt and ſecond be equal to the diſtance between the third and the fourth, let the diſtance from the ſecond to the third be what it will, theſe numbers will be proportional. For becauſe the diſtances AC, IL, are equal, AB ſhall be to the increment D *s*, as IK is to the increment MT. Wherefore, by compoſition, AB . DC : : IK : ML. And, contrariwiſe, if four numbers be proportional, the diſtance between the firſt and ſecond ſhall be equal to the diſtance between the third and fourth.

The diſtance between any two numbers is called *the logarithm of the ratio of thoſe numbers*; and, indeed, doth not meaſure the ratio itſelf, but the number of terms in a given ſeries of geometrical proportionals, proceeding from one number to another, and defines the number of equal ratios by the compoſition whereof the ratios of number is known.

Logarithmic Lines. For many mechanical purpoſes it is convenient to have the logarithms of numbers laid down on ſcales, as well as the logarithmic ſines and tangents; by which means, computations may be carried on by mere menſuration with compaſſes. Lines of this kind are always put on the common Gunter's ſcale; but as theſe inſtruments muſt be extended to a very great length, in order to contain any conſiderable quantity of numbers, it becomes an object of importance to ſhorten them. Such an improvement has been made by Mr William Nicholſon, and publiſhed in the 77th volume of the Philoſophical Tranſactions. The principles on which the conſtruction of his inſtruments depends are as follow:

1. If two geometrical ſeries of numbers, having the ſame common ratio, be placed in order with the terms oppoſite to each other, the ratio between any term in one ſeries and its oppoſite in the other will be conſtant: Thus,

2 6 18 54 162, &c.
3 9 27 81 243, &c. Then,
2 3 6 9 18 27 54 81 162 243, &c.

where it is evident, that each of the terms in the upper ſeries is exactly two-thirds of the correſponding one in the lower.

2. The ratio of any two terms in one ſeries will be the ſame with that between thoſe which have an equal diſtance in the other.

3. In all ſuch geometrical ſeries as have the ſame ratio, the property above-mentioned takes place, tho' we compare the terms of any ſeries with thoſe of another: Thus,

2 4 8 16 32 64, &c.
3 6 12 24 48 96, &c.
4 8 16 32 64 128, &c.
5 10 20 40 80 160, &c.; where it is plain that 2, 4, 3, 6; alſo 2, 4, 4, 8, and 2, 4, 5, 10, &c. have the ſame ratio with that of each ſeries.

4. If the differences of the logarithms of the numbers be laid in order upon equidiſtant parallel right lines, in ſuch a manner that a right line drawn acroſs the whole ſhall interſect it at diviſions denoting numbers in geometrical progreſſion; then, from the condition of the arrangement, and the property of this logarithmic line, it follows, 1ſt, That every right line ſo drawn will, by its interſections, indicate a geometrical ſeries of numbers; 2dly, That ſuch ſeries as are indicated by theſe right lines will have the ſame common ratio; and, 3dly, That the ſeries thus indicated by two parallel right lines, ſuppoſed to move laterally, without changing either their mutual diſtance or paralleliſm to themſelves, will have each the ſame ratio, and in all ſeries indicated by ſuch two lines, the ratio between an antecedent and conſequent; the former taken upon one line, and the latter upon another, will be alſo the ſame.

Logarithmic Lines.

The 1*ſt* of theſe propoſitions is proved in the following manner. Let the lines AB, CD, EF, repreſent parts of the logarithmic line arranged according to the proportion already mentioned; and let GH be a right line paſſing through the points *e*, *c*, *a*, denoting numbers in geometrical progreſſion; then will any other line IK, drawn acroſs the arrangement, likewiſe paſs through three points *f*, *d*, *b*, in geometrical progreſſion. From one of the points of interſection *f* in the laſt mentioned line IK, draw the line *fg* parallel to GH, and interſecting the arrangement in the points *i*, *h*; and the ratios of the numbers *e*, *f c*, *i*, will be equal, as well as of *a*, *b*; becauſe the intervals on the logarithmic line, or differences of the logarithms of thoſe numbers, are equal. Again, the point *f*, the line *id*, and the line *hb*, are in arithmetical progreſſion denoting the differences between the logarithms of the numbers themſelves; whence the quotients of the numbers are in geometrical progreſſion. Plate CCLXXIII fig. 11.

The 2*d* propoſition is proved in a ſimilar manner. For as it was ſhown that the line *fg*, parallel to GH, paſſes through points of diviſion denoting numbers in the ſame continued ratio as thoſe indicated by the line GH; it may alſo be ſhown, that the line LM parallel to any other line IK, will paſs through a ſeries of points denoting numbers which have the ſame continued ratio with thoſe indicated by the line IK, to which it is parallel.

The 3*d* propoſition ariſes from the paralleliſm of the lines to their former ſituation; by which means they indicate numbers in a geometrical ſeries, having the ſame common ratio as before: their diſtance on the logarithmic line alſo remains unchanged; whence the differences between the logarithms of the oppoſite numbers, and of conſequence their ratios, will always be conſtant.

5. Suppoſing now an antecedent and conſequent to be given in any geometrical ſeries, it will always be poſſible to find them, provided the line be of unlimited length. Drawing two parallel lines, then, through each of the numbers, and ſuppoſing the lines to move without changing their direction or parallel ſituation, they will continually deſcribe new antecedents and conſequents in the ſame geometrical ſeries as before.

6. Though the logarithmic line contain no greater range of numbers than from 1 to 10, it will not be found neceſſary for the purpoſes of computation to repeat it. The only thing requiſite is to have a ſlider or beam with two fixed points at the diſtance of the interval betwixt 1 and 10, and a moveable point be made to range betwixt them always to indicate the antecedent; then, if the conſequent fixed point fall without the rule, the other fixed point will always denote the diviſion on which it would have fallen had the rule been prolonged; and this contrivance may eaſily be adapted to any arrangement of parallel lines whatever. The arrangement of right lines, however, ought always to be diſpoſed in ſuch a manner as to occupy a

right

Logarithmic Lines.

right angled parallelogram, or the croſs line already mentioned ought always to be at right angles to the length of the ruler.

Fig. 7. is a ruler conſiſting of ten parallel lines. Fig. 8. a beam-compaſs for meaſuring the intervals. B, A, C, are the parts which apply to the ſurface of the ruler; the middle one, A, being moveable ſidewiſe in a groove in the piece DE, ſo as always to preſerve its paralleliſm to the external pieces DC, which are fixed at a diſtance equal to the length of the ruler, and have their edges placed in ſuch a manner as to form with the parallel lines which they interſect a ratio, which by compoſition is $\frac{1}{10}$; which in the preſent caſe requires them to be at right angles to the length. The piece DE is applied to the edge FG of the ruler. The edges or borders H, I, K, L, are more conveniently made of tranſparent horn, or tortoiſe-ſhell, than of any opaque matter.

In uſing this ruler, apply the edge of either B or C to the conſequent, and ſlide the piece A to the antecedent; obſerving the difference between the numbers on the pieces denoting the lines they are found on: then, applying the ſame edge of A to any other antecedent, the other piece B or C will interſect a conſequent in the ſame ratio upon that line, having the ſame ſituation with regard to the antecedent that the line of the former conſequent had to its antecedent. But if B be the conſequent piece, and fall without the ruler, the piece C will ſhow the conſequent one line lower; or if C, in like manner, fall without the ruler, then B will ſhow the conſequent one line higher. "It might be convenient (ſays Mr Nicholſon) for the purpoſe of computation, to make inſtruments of this kind with one hundred or more lines: but in the preſent inſtrument, the numbers on the pieces will anſwer the ſame purpoſe; for if a conſequent fall upon a line at any given number of intervals without the ruler, it will be found on that line of the arrangement which occupies the ſame number of intervals reckoned inwards from the oppoſite edge of the ruler."

Fig. 9. is an inſtrument on the plan of a Gunter's ſcale of $28\frac{1}{2}$ inches long, invented by the late Mr Robertſon. There is a moveable piece AB in the ſlider GH, acroſs which is drawn a fine line: the ſlider having alſo lines CD, EF, drawn acroſs it at diſtances from each other equal to the length of the ruler AB. In uſing the inſtrument, the line CD or EF is to be placed at the conſequent, and the line in AB at the antecedent: then, if the piece AB be placed at any other antecedent, the ſame line CD or EF will indicate its conſequent in the ſame ratio taken the ſame way: that is, if the antecedent and conſequent lie on the ſame ſide of the ſlider, all other antecedents and conſequents in that ratio will be in the ſame manner; and the contrary if they do not. But if the conſequent line fall without the rule, the other fixed line on the ſlider will ſhow the conſequent, but on the contrary ſide of the ſlider to that where it would elſe have been ſeen by means of the firſt conſequent line.

Logarithmic Lines.

Fig. 10. is a circular inſtrument equivalent to the former; conſiſting of three concentric circles engraved and graduated upon a plate of an inch and an half diameter. Two legs A and B proceed from the centre, having right-lined edges in the direction of radii; and are moveable either ſingly or together. In uſing the inſtrument, place one of the edges at the antecedent and the other at the conſequent, and fix them at the angle. Move the two legs then together; and having placed the antecedent leg at any other number, the other will give the conſequent one in the like poſition on the lines. If the line CD happen to lie between the legs, and B be the conſequent leg, the number ſought will be found one line farther from the centre than it would otherwiſe have been; and on the contrary, it will be found one line nearer in the like caſe, if A be the conſequent leg. "This inſtrument (ſays Mr Nicholſon) differing from that repreſented fig. 7. only in its circular form, and the advantages reſulting from that form, the lines muſt be taken to ſucceed each other in the ſame manner laterally; ſo that numbers which fall either within or without the arrangement of circles, will be found on ſuch lines of the arrangement as would have occupied the vacant places if the ſucceſſion of lines had been indefinitely repeated ſidewiſe.

"I approve of this conſtruction as ſuperior to every other which has yet occurred to me, not only in point of convenience, but likewiſe in the probability of being better executed; becauſe ſmall arcs may be graduated with very great accuracy, by diviſions transferred from a larger original. The inſtrument, fig. 7. may be contained conveniently in a circle of about four inches and an half diameter.

"The circular inſtrument is a combination of the Gunter's line and the ſector, with the improvements here pointed out. The property of the ſector may be uſeful in magnifying the differences of the logarithms in the upper parts of the line of ſines, the middle of the tangents, and the beginning of the verſed ſines. It is even poſſible, as mathematicians will eaſily conceive, to draw ſpirals, on which graduations of parts, every where equal to each other, will ſhow the ratios of thoſe lines by moveable radii, ſimilar to thoſe in this inſtrument."

LOGIC.

LOGIC is the art of thinking and reaſoning juſtly; or, it may be defined the ſcience or hiſtory of the human mind, inaſmuch as it traces the progreſs of our knowledge from our firſt and moſt ſimple conceptions through all their different combinations, and all thoſe numerous deductions that reſult from variouſly comparing them one with another.

The preciſe buſineſs of logic therefore is, To explain the nature of the human mind, and the proper manners of conducting its ſeveral powers, in order to the attainment of truth and knowledge. It lays open thoſe errors and miſtakes we are apt, through inattention, to run into; and teaches us how to diſtinguiſh between truth, and what only carries the appearance of it. By theſe means we grow acquainted with the nature and force of the underſtanding; ſee what things lie within its reach.

reach; where we may attain certainty and demonſtration; and when we muſt be contented with probability.

This ſcience is generally divided into four parts, viz. *Perception*, *Judgement*, *Reaſoning*, and *Method*. This diviſion comprehends the whole hiſtory of the ſenſations and operations of the human mind.

Part I. Of PERCEPTION.

WE find ourſelves ſurrounded with a variety of objects, which acting differently upon our ſenſes, convey diſtinct impreſſions into the mind, and thereby rouſe the attention and notice of the underſtanding. By reflecting too on what paſſes within us, we become ſenſible of the operations of our own minds, and attend to them as a new ſet of impreſſions. But in all this there is only bare *conſciouſneſs*. The mind, without proceeding any farther, takes notice of the impreſſions that are made upon it, and views things in order, as they preſent themſelves one after another. This attention of the underſtanding to the object acting upon it, whereby it becomes ſenſible of the impreſſions they make, is called by logicians *perception*; and the notices themſelves, as they exiſt in the mind, and are there treaſured up to be the materials of thinking and knowledge, are diſtinguiſhed by the name of *ideas*. In the article Metaphysics it ſhall be ſhown at large, how the mind, being furniſhed with ideas, contrives to diverſify and enlarge its ſtock: we have here chiefly to conſider the means of making known our thoughts to others; that we may not only underſtand how knowledge is acquired, but alſo in what manner it may be communicated with the greateſt certainty and advantage.

Chap. I. *Of Words, conſidered as the Signs of our Ideas.*

1 Words furniſh the means of recording our own thoughts;

I. Our ideas, though manifold and various, are nevertheleſs all within our own breaſts, inviſible to others, nor can of themſelves be made appear. But God, deſigning us for ſociety, and to have fellowſhip with thoſe of our kind, has provided us with organs fitted to frame articulate ſounds, and given us alſo a capacity of uſing thoſe ſounds as ſigns of internal conceptions. Hence ſpring words and language: for, having once pitched upon any ſound to ſtand as the mark of an idea in the mind, cuſtom by degrees eſtabliſhes ſuch a connection between them, that the appearance of the idea in the underſtanding always brings to our remembrance the ſound or name by which it is expreſſed; as in like manner the hearing of the ſound never fails to excite the idea for which it is made to ſtand. And thus it is eaſy to conceive how a man may record his own thoughts, and bring them again into view in any ſucceeding period of life. For this connection being once ſettled, as the ſame ſounds will always ſerve to excite the ſame ideas; if he can but contrive to regiſter his words in the order and diſpoſition in which the preſent train of his thoughts preſent themſelves to his imagination, it is evident he will be able to recal theſe thoughts at pleaſure, and that too in the very manner of their firſt appearance. Accordingly we find, that the inventions of writing and printing, by enabling us to fix and perpetuate ſuch periſhable things as ſounds, have alſo furniſhed us with the means of giving a kind of permanency to the tranſactions of the mind, inſomuch that they may be in the ſame manner ſubjected to our review as any other objects of nature.

2 And of the mutual communication of knowledge from one man to another.

II. But, beſides the ability of recording our own thoughts, there is this farther advantage in the uſe of external ſigns, that they enable us to communicate our thoughts to *others*, and alſo to receive information of what paſſes in *their* breaſts. For any number of men, having agreed to eſtabliſh the ſame ſounds as ſigns of the ſame ideas, it is apparent that the repetition of theſe ſounds muſt excite the like perceptions in each, and create a perfect correſpondence of thoughts. When, for inſtance, any train of ideas ſucceed one another in my mind, if the names by which I am wont to expreſs them have been annexed by thoſe with whom I converſe to the very ſame ſet of ideas, nothing is more evident, than that, by repeating thoſe names according to the tenor of my preſent conceptions, I ſhall raiſe in their minds the ſame courſe of thought as has taken poſſeſſion of my own. For by barely attending to what paſſes within themſelves upon hearing the ſounds which I repeat, they will alſo become acquainted with the ideas in my underſtanding, and have them in a manner laid before their view. So that we here clearly perceive how a man may communicate his ſentiments, knowledge, and diſcoveries to others, if the language in which he converſes be extenſive enough to mark all the ideas and tranſactions of his mind. But as this is not always the caſe, and men are often obliged to invent terms of their own to expreſs new views and conceptions of things; it may be aſked, how in theſe circumſtances we can become acquainted with the thoughts of another, when he makes uſe of words, to which we have never annexed any ideas, and that of courſe can raiſe no perceptions in our minds? In order to unveil this myſtery, and give ſome little inſight into the foundation, growth, and improvement of language, the following obſervations will be found of conſiderable moment.

3 Simple ideas cannot be conveyed into the mind by words, or a deſcription.

III. Firſt, that no word can be to any man the ſign of an idea, till that idea comes to have a real exiſtence in his mind. For names, being only ſo far intelligible as they denote known internal conceptions; where they have none ſuch to anſwer them, there they are plainly ſounds without ſignification, and of courſe convey no inſtruction or knowledge. But no ſooner are the ideas to which they belong raiſed in the underſtanding, than, finding it eaſy to connect them with the eſtabliſhed names, we can join in any agreement of this kind made by others, and thereby enjoy the benefit of their diſcoveries. The firſt thing therefore to be conſidered is, how theſe ideas may be conveyed into the mind; that being there, we may learn to con-

nect them with their appropriated ſounds, and ſo become capable of underſtanding others when they make uſe of theſe ſounds in laying open and communicating their thoughts. Now, to comprehend this diſtinctly, it will be neceſſary to attend to the diviſion of our ideas into ſimple and complex, (ſee METAPHYSICS.) And firſt, as for our ſimple ideas; they can find no admiſſion into the mind, but by the two original fountains of knowledge, ſenſation and reflection. If therefore any of theſe have as yet no being in the underſtanding, it is impoſſible by words or a deſcription to excite them there. A man who had never felt the ſenſation of *heat*, could not be brought to comprehend that ſenſation by any thing we might ſay to explain it. If we would really produce the idea in him, it muſt be by applying the proper object to his ſenſes, and bringing him within the influence of a hot body. When this is done, and experience has taught him the perception to which men have annexed the name *heat*, it then becomes to him the ſign of that idea, and he thenceforth underſtands the meaning of the term, which, before, all the words in this world would not have been ſufficient to convey into his mind. The caſe is the ſame in reſpect of light and colours. A man born blind, and thereby deprived of the only conveyance for the ideas of this claſs, can never be brought to underſtand the names by which they are expreſſed. The reaſon is plain: they ſtand for ideas that have no exiſtence in his mind; and as the organ appropriated to their reception is wanting, all other contrivances are vain, nor can they by any force or deſcription be raiſed in his imagination. But it is quite otherwiſe in our complex notions. For theſe being no more than certain combinations of ſimple ideas, put together in various forms; if the original ideas out of which the collections are made have already got admiſſion into the underſtanding, and the names ſerving to expreſs them are known; it will be eaſy, by enumerating the ſeveral ideas concerned in the compoſition, and marking the order and manner in which they are united, to raiſe any complex conception in the mind. Thus the idea anſwering to the word *rainbow* may be readily excited in the imagination of another who has never ſeen the appearance itſelf, by barely deſcribing the figure, largeneſs, poſition, and order of colours; if we ſuppoſe theſe ſeveral ſimple ideas, with their names, ſufficiently known to him.

4 The names of complex ideas definable, thoſe of ſimple ideas not.

IV. And this leads to a ſecond obſervation upon this ſubject, namely, That words ſtanding for complex ideas are all definable, but thoſe by which we denote ſimple ideas are not; for ſimple ideas being ſecondary perceptions, which have no other entrance into the mind than by ſenſation or reflection, can only be got by experience, from the ſeveral objects of nature, proper to produce thoſe perceptions in us. Words indeed may very well ſerve to remind us of them, if they have already found admiſſion into the underſtanding, and their connection with the eſtabliſhed names is known; but they can never give them their original being and exiſtence there. And hence it is, that when any one aſks the meaning of a word denoting a ſimple idea, we pretend not to explain it to him by a definition, well knowing that to be impoſſible; but, ſuppoſing him already acquainted with the idea, and only ignorant of the name by which it is called, we either mention it to him by ſome other name with which we preſume he knows its connection, or appeal to the object where the idea itſelf is found. Thus, were any one to aſk the meaning of the word *white*, we ſhould tell him it ſtood for the ſame idea as *albus* in Latin, or *blanc* in French; or, if we thought him a ſtranger to theſe languages, we might appeal to an object producing the idea, by ſaying it denoted the colour we obſerve in *ſnow* or *milk*. But this is by no means a definition of the word, exciting a new idea in his underſtanding; but merely a contrivance to remind him of a known idea, and teach him its connection with the eſtabliſhed name. For if the ideas after which he inquires have never yet been raiſed in his mind; as ſuppoſe one who had ſeen no other colours than *black* and *white*, ſhould aſk the meaning of the word *ſcarlet*; it is eaſy to perceive, that it would be no more poſſible to make him comprehend it by words, or a definition, than to introduce the ſame perception into the imagination of a man born blind. The only method in this caſe is, to preſent ſome object, by looking at which the perception itſelf may be excited; and thus he will learn both the name and the idea together.

5 Experience and obſervation bring men to an agreement in the names of ſimple ideas.

V. But how comes it to paſs that men agree in the names of their ſimple ideas, ſeeing they cannot view the perceptions in one another's minds, nor make known theſe perceptions by words to others? The effect is produced by experience and obſervation. Thus finding, for inſtance, that the name of *heat* is annexed to that ſenſation which men feel when they approach the fire, I make it alſo the ſign of the ſenſation excited in me by ſuch an approach, nor have any doubt but it denotes the ſame perception in my mind as in theirs. For we are naturally led to imagine, that the ſame objects operate alike upon the organs of the human body, and produce an uniformity of ſenſations. No man fancies, that the idea raiſed in him by the taſte of *ſugar*, and which he calls *ſweetneſs*, differs from that excited in another by the like means; or that *wormwood*, to whoſe reliſh he has given the epithet *bitter*, produces in another the ſenſation which he denotes by the word *ſweet*. Preſuming therefore upon this conformity of perceptions, when they ariſe from the ſame objects, we eaſily agree as to the names of our ſimple ideas: and if at any time, by a more narrow ſcrutiny into things, new ideas of this claſs come in our way, which we chooſe to expreſs by terms of our own invention; theſe names are explained, not by a definition, but by referring to the objects whence the ideas themſelves may be obtained.

6 The conveyance of complex ideas by definitions, a wiſe contrivance in nature;

VI. Being in this manner furniſhed with ſimple ideas, and the names by which they are expreſſed; the meaning of terms that ſtand for complex ideas is eaſily got, becauſe the ideas themſelves anſwering to theſe terms may be conveyed into the mind by definitions. For our complex notions are only certain combinations of ſimple ideas. When therefore theſe are enumerated, and the manner in which they are united into one conception explained, nothing more is wanting to raiſe that conception in the underſtanding; and thus the term denoting it comes of courſe to be underſtood. And here it is worth while to reflect a little upon the wiſe contrivance of nature, in thus furniſhing us with the very apteſt means of communicating our thoughts. For were it not ſo ordered,

that

that we could thus convey our complex ideas from one to another by definitions, it would in many cafes be impoffible to make them known at all. This is apparent in thofe ideas which are the proper work of the mind. For as they exift only in the underftanding, and have no real objects in nature in conformity to which they are framed; if we could not make them known by defcription, they muft lie for ever hid within our own breafts, and be confined to the narrow acquaintance of a fingle mind. All the fine fcenes that arife from time to time in the poet's fancy, and by his lively painting give fuch entertainment to his readers; were he deftitute of this faculty of laying them open to the view of others by words and defcription, could not extend their influence beyond his own imagination, or give joy to any but the original inventor.

7 And of great avail towards the improvement of knowledge

VII. There is this farther advantage in the ability we enjoy of communicating our complex notions by definitions; that as thefe make by far the largeft clafs of our ideas, and moft frequently occur in the progrefs and improvement of knowledge, fo they are by thefe means imparted with the greateft readinefs, than which nothing would tend more to the increafe and fpreading of fcience: for a definition is foon perufed; and if the terms of it are well underftood, the idea itfelf finds an eafy admiffion into the mind. Whereas in fimple perceptions, where we are referred to the objects producing them, if thefe cannot be come at, as is fometimes the cafe, the names by which they are expreffed muft remain empty founds. But new ideas of this clafs occurring very rarely in the fciences, they feldom create any great obftruction. It is otherwife with our complex notions; for every ftep we take leading us into new combinations and views of things, it becomes neceffary to explain thefe to others, before they can be made acquainted with our difcoveries: and as the manner of definitions is eafy, requiring no apparatus but that of words, which are always ready, and at hand; hence we can with the lefs difficulty remove fuch obftacles as might arife from terms of our own invention, when they are made to ftand for new complex ideas fuggefted to the mind by fome prefent train of thinking. And thus at laft we are let into the myftery hinted at in the beginning of this chapter, *viz.* how we may become acquainted with the thoughts of another, when he makes ufe of words to which we have as yet joined no ideas. The anfwer is obvious from what has been already faid. If the terms denote fimple perceptions, he muft refer us to thefe objects of nature whence the perceptions themfelves are to be obtained; but, if they ftand for complex ideas, their meaning may be explained by a *definition*.

CHAP. II. *Of Definitions.*

8 Definition defined.

I. A Definition *is the unfolding of fome conception of the mind, anfwering to the word or term made ufe of as the fign of it.* Now as, in exhibiting any idea to another, it is neceffary that the defcription be fuch as may excite that precife idea in his mind; hence it is plain that definitions, properly fpeaking, are not arbitrary, but confined to the repreffenting of certain determinate fettled notions, fuch namely as are annexed by the fpeaker or writer to the words he ufes. As nevertheleſs it is univerfally allowed that the fignification of words is perfectly voluntary, and not the effect of any natural and neceffary connection between them and the ideas for which they ftand; fome may perhaps wonder why definitions are not fo too. In order therefore to unravel this difficulty, and fhow diftinctly what is and what is not arbitrary in fpeech, we muft carefully diftinguifh between the connection of our words and ideas, and the unfolding of the ideas themfelves.

9 The connection between words and ideas, a perfectly voluntary eftabliſhment.

II. Firft, as to the connection of our words and ideas; this, it is plain, is a purely arbitrary inftitution. When, for inftance, we have in our minds the idea of any particular fpecies of metals, the calling it by the name *gold* is an effect of the voluntary choice of men fpeaking the fame language, and not of any peculiar aptnefs in that found to expreſs that idea. Other nations we find make ufe of different founds, and with the fame effect. Thus *aurum* denotes that idea in Latin, and *or* in French; and even the word *gold* itfelf would have as well ferved to expreſs the idea of that metal which we call *filver*, had cuftom in the beginning eftabliſhed it.

10 The defcription of ideas not fo, but bounded to the repreſentation of that preciſe appearance by which they are diſtinguiſhed among themſelves.

III. But although we are thus entirely at liberty in connecting any idea with any found, yet it is quite otherwife in unfolding the ideas themfelves. For every idea having a preciſe appearance of its own, by which it is diftinguifhed from every other idea; it is manifeft, that in laying it open to others, we muft ftudy fuch a defcription as fhall exhibit that peculiar appearance. When we have formed to ourfelves the idea of a figure bounded by four equal fides, joined together at right angles, we are at liberty to expreſs that idea by any found, and call it either a *fquare* or a *triangle*. But whichever of thefe names we ufe, fo long as the idea is the fame, the defcription by which we would fignify it to another muft be fo too. Let it be called *fquare* or *triangle*, it is ftill a figure having four equal fides, and all its angles right ones. Hence we clearly fee what is and what is not arbitrary in the ufe of words. The eftabliſhing any found as the mark of fome determinate idea in the mind, is the effect of free choice, and a voluntary combination among men: and as different nations make ufe of different founds to denote the fame ideas, hence proceeds all that variety of languages which we meet with in the world. But when a connection between our ideas and words is once fettled, the unfolding of the idea anfwering to any word, which properly conftitutes a definition, is by no means an arbitrary thing: for here we are bound to exhibit that preciſe conception which either the ufe of language, or our own particular choice, hath annexed to the term we ufe.

11 Cauſes of the obſcurity that has hitherto perplexed the theory of definitions.

IV. And thus it appears, that definitions, confidered as defcriptions of ideas in the mind, are fteady and invariable, being bounded to the repreſentation of theſe preciſe ideas. But then, in the application of definitions to particular names, we are altogether left to our own free choice. Becauſe as the connecting of any idea with any found is a perfectly arbitrary inftitution, the applying the defcription of that idea to that found muft be fo too. When therefore logicians tell us that the definition of the name is arbitrary, they mean no more than this; that as different ideas may

be connected with any term, according to the good pleasure of him that uses it; in like manner may different descriptions be applied to the term suitable, to the ideas so connected. But this connection being settled, and the term considered as the sign of some fixed idea in the understanding, we are no longer left to arbitrary explications, but must study such a description as corresponds with that precise idea. Now this alone, according to what has been before laid down, ought to be accounted a definition. What seems to have occasioned no small confusion in this matter, is, that many explanations of words, where no idea is unfolded, but merely the connection between some word and idea asserted, have yet been dignified with the name of definitions. Thus, when we say that *a clock is an instrument by which we measure time*; that is by some called a definition; and yet it is plain that we are beforehand supposed to have an idea of this instrument, and only taught that the word *clock* serves in common language to denote that idea. By this rule all explications of words in our dictionaries will be definitions, nay, the names of even simple ideas may be thus defined. *White*, we may say, is the colour we observe in snow or milk; *heat* the sensation produced by approaching the fire; and so in innumerable other instances. But these, and all others of the like kind, are by no means definitions, exciting new ideas in the understanding, but merely contrivances to remind us of known ideas, and teach their connection with the established names.

11 Complex ideas alone capable of that kind of description which goes by the name of a definition.

V. But now in definitions properly so called, we first consider the term we use, as the sign of some inward conception, either annexed to it by custom, or our own free choice; and then the business of the definition is to unfold and explicate that idea. As therefore the whole art lies in giving just and true copies of our ideas; a definition is then said to be made perfect, when it serves distinctly to excite the idea described in the mind of another, even supposing him before wholly unacquainted with it. This point settled, let us next inquire what those ideas are which are capable of being thus unfolded? And in the first place it is evident, that all our simple ideas are necessarily excluded. We have seen already that experience alone is to be consulted here, insomuch that if either the objects whence they are derived come not in our way, or the avenues appointed by nature for their reception, are wanting, no description is sufficient to convey them into the mind. But where the understanding is already supplied with these original and primitive conceptions, as they may be united together in an infinity of different forms; so may all their several combinations be distinctly laid open, by enumerating the simple ideas concerned in the various collections, and tracing the order and manner in which they are linked one to another. Now these combinations of simple notices constitute what we call our complex notions; whence it is evident, that complex ideas, and those alone, admit of that kind of description which goes by the name of a definition.

VI. Definitions, then, are pictures or representations of our ideas; and as these representations are then only possible when the ideas themselves are complex, it is obvious to remark, that definitions cannot have place but where we make use of terms standing for such complex ideas. But our complex ideas, being, as we have said, nothing more than different combinations of simple ideas; we then know and comprehend them perfectly, when we know the several simple ideas of which they consist, and can so put them together in our minds as may be necessary towards the framing of that peculiar connection which gives every idea its distinct and proper appearance.

13 Two things required in a definition, to enumerate the ideas, and explain the manner of their combinations.

VII. Two things are therefore required in every definition: first, That all the original ideas, out of which the complex one is formed, be distinctly enumerated; and, secondly, That the order and manner of combining them into one conception be clearly explained. Where a definition has these requisites, nothing is wanting to its perfection; because every one who reads it and understands the terms, seeing at once what ideas he is to join together, and also in what manner, can at pleasure form in his own mind the complex conception answering to the term defined. Let us, for instance, suppose the word *square* to stand for that idea by which we represent to ourselves a figure whose sides subtend quadrants of a circumscribed circle. The parts of this idea are the sides bounding the figure. These must be four in number, and all equal among themselves, because they are each to subtend a fourth part of the same circle. But, besides these component parts, we must also take notice of the manner of putting them together, if we would exhibit the precise idea for which the word *square* here stands. For four equal right lines, any-how joined, will not subtend quadrants of a circumscribed circle. A figure with this property must have its sides standing also at right angles. Taking in therefore this last consideration respecting the manner of combining the parts, the idea is fully described, and the definition thereby rendered complete. For a figure bounded by four equal sides, joined together at right angles, has the property required; and is moreover the only right-lined figure to which that property belongs.

14 How we are to proceed to arrive at just and adequate definitions.

VIII. It will now be obvious to every one, in what manner we ought to proceed, in order to arrive at just and adequate definitions. First, we are to take an exact view of the idea to be described, trace it to its original principles, and mark the several simple perceptions that enter into the composition of it. Secondly, we are to consider the particular manner in which these elementary ideas are combined, in order to the forming of that precise conception for which the term we make use of stands. When this is done, and the idea wholly unravelled, we have nothing more to do than fairly transcribe the appearance it makes to our own minds. Such a description, by distinctly exhibiting the order and number of our primitive conceptions, cannot fail to excite at the same time in the mind of every one that reads it, the complex idea resulting from them; and therefore attains the true and proper end of a definition.

Chap. III. *Of the Composition and Resolutions of our Ideas, and the Rules of Definition thence arising.*

I. The rule laid down in the foregoing chapter is general, extending to all possible cases; and is indeed that to which alone we can have recourse, where any

15 In compounding our ideas, we proceed by a ſucceſſive gradation.

doubt or difficulty ariſes. It is not, however, neceſſary that we ſhould practiſe it in every particular inſtance. Many of our ideas are extremely complicated, inſomuch that to enumerate all the ſimple perceptions out of which they are formed, would be a very troubleſome and tedious work. For this reaſon logicians have eſtabliſhed certain compendious rules of defining, of which it may not be amiſs here to give ſome account. But in order to the better underſtanding of what follows, it will be neceſſary to obſerve, that there is a certain gradation in the compoſition of our ideas. The mind of man is very limited in its views, and cannot take in a great number of objects at once. We are therefore fain to proceed by ſteps, and make our firſt advances ſubſervient to thoſe which follow. Thus, in forming our complex notions, we begin at firſt with but a few ſimple ideas, ſuch as we can manage with eaſe, and unite them together into one conception. When we are provided with a ſufficient ſtock of theſe, and have by habit and uſe rendered them familiar to our minds, they become the component parts of other ideas ſtill more complicated, and form what we may call a ſecond order of compound notions. This proceſs, as is evident, may be continued to any degree of compoſition we pleaſe, mounting from one ſtage to another, and enlarging the number of combinations.

16 Hence ideas of this claſs beſt comprehended, when we advance gradually through all the ſeveral orders.

II. But now in a ſeries of this kind, whoever would acquaint himſelf perfectly with the laſt and higheſt order of ideas, finds it much the moſt expedient method to proceed gradually through all the intermediate ſteps. For, were he to take any very compound idea to pieces, and, without regard to the ſeveral claſſes of ſimple perceptions that have already been formed into diſtinct combinations, break it at once into its original principles, the number would be ſo great as perfectly to confound the imagination, and overcome the utmoſt reach and capacity of the mind. When we ſee a prodigious multitude of men jumbled together in crowds, without order or any regular poſition, we find it impoſſible to arrive at an exact knowledge of their number. But if they are formed into ſeparate battalions, and ſo ſtationed as to fall within the leiſure ſurvey of the eye; by viewing them ſucceſſively and in order, we come to an eaſy and certain determination. It is the ſame in our complex ideas. When the original perceptions, out of which they are framed, are very numerous, it is not enough that we take a view of them in looſe and ſcattered bodies; we muſt form them into diſtinct claſſes, and unite theſe claſſes in a juſt and orderly manner, before we can arrive at a true knowledge of the compound notices reſulting from them.

17 Our definitions ſhould keep pace with our ideas, and obſerve a like gradation.

III. This gradual progreſs of the mind to its compound notions, through a variety of intermediate ſteps, plainly points out the manner of conducting the definitions by which theſe notions are conveyed into the minds of others. For as the ſeries begins with ſimple and eaſy combinations, and advances through a ſucceſſion of different orders, riſing one above another in the degree of compoſition, it is evident, that, in a train of definitions expreſſing theſe ideas, a like gradation is to be obſerved. Thus the complex ideas of the loweſt order can no otherwiſe be deſcribed than by enumerating the ſimple ideas out of which they are made, and explaining the manner of their union. But then in the ſecond, or any other ſucceeding order, as they are formed out of thoſe gradual combinations, and conſtitute the inferior claſſes, it is not neceſſary, in deſcribing them, to mention one by one all the ſimple ideas of which they conſiſt. They may be more diſtinctly and briefly unfolded, by enumerating the compound ideas of a lower order, from whoſe union they reſult, and which are all ſuppoſed to be already known in conſequence of previous definitions. Here then it is that the logical method of defining takes place; which, that it may be the better underſtood, we ſhall explain ſomewhat more particularly the ſeveral ſteps and gradations of the mind in compounding its ideas, and thence deduce that peculiar form of a definition which logicians have thought fit to eſtabliſh.

18 The ſteps by which the mind proceeds from particular to general ideas.

IV. All the ideas we receive from the ſeveral objects of nature that ſurround us, repreſent diſtinct individuals. Theſe individuals, when compared together, are found in certain particulars to reſemble each other. Hence, by collecting the reſembling particulars into one conception, we form the notion of a *ſpecies*. And here let it be obſerved, that this laſt idea is leſs complicated than that by which we repreſent any of the particular objects contained under it. For the idea of the ſpecies excludes the peculiarities of the ſeveral individuals, and retains only ſuch properties as are common to them all. Again, by comparing ſeveral ſpecies together, and obſerving their reſemblance, we form the idea of a *genus*; where, in the ſame manner as before, the compoſition is leſſened, becauſe we leave out what is peculiar to the ſeveral ſpecies compared, and retain only the particulars wherein they agree. It is eaſy to conceive the mind proceeding thus from one ſtep to another, and advancing through its ſeveral claſſes of general notions, until at laſt it comes to the higheſt genus of all, denoted by the word *being*, where the bare idea of exiſtence is only concerned.

19 The conduct of the mind in compounding its ideas, as it advances thro' the different orders of perception.

V. In this procedure we ſee the mind unravelling a complex idea, and tracing it in the aſcending ſcale, from greater or leſs degrees of compoſition, until it terminates in one ſimple perception. If now we take the ſeries the contrary way, and, beginning with the laſt or higheſt genus, carry our view downwards, through all the inferior genera and ſpecies, quite to the individuals, we ſhall thereby arrive at a diſtinct apprehenſion of the conduct of the underſtanding in compounding its ideas. For, in the ſeveral claſſes of our perceptions, the higheſt in the ſcale is for the moſt part made up of but a few ſimple ideas, ſuch as the mind can take in and ſurvey with eaſe. This firſt general notion, when branched out into the different ſubdiviſions contained under it, has in every one of them ſomething peculiar, by which they are diſtinguiſhed among themſelves; inſomuch that, in deſcending from the genus to the ſpecies, we always ſuperadd ſome new idea, and thereby increaſe the degree of compoſition. Thus the idea denoted by the word *figure* is of a very general nature, and compoſed of but few ſimple perceptions, as implying no more than ſpace every where bounded. But if we deſcend farther, and conſider the boundaries of this ſpace, as that they may be either lines or ſurface, we fall into the ſeveral ſpecies of figure. For where the ſpace is bounded by one or more ſurfaces, we give it the

name

name of a *ſolid figure*; but where the boundaries are lines, it is called a *plain figure* (A).

20 The idea of the ſpecies found by ſuperadding the ſpecific difference to the genus.

VI. In this view of things it is evident, that the ſpecies is formed by ſuperadding a new idea to the genus. Here, for inſtance, the genus is circumſcribed ſpace. If now to this we ſuperadd the idea of a circumſcription by lines, we frame the notion of that ſpecies of figures which are called *plain*; but if we conceive the circumſcription to be by ſurfaces, we have the ſpecies of ſolid figures. This ſuperadded idea is called the *ſpecific difference*, not only as it ſerves to divide the ſpecies from the genus, but becauſe, being different in all the ſeveral ſubdiviſions, we thereby alſo diſtinguiſh the ſpecies one from another. And as it is likewiſe that conception, which, by being joined to the general idea, completes the notion of the ſpecies; hence it is plain, that the genus and ſpecific difference are to be conſidered as the proper and conſtituent parts of the ſpecies. If we trace the progreſs of the mind ſtill farther, and obſerve it advancing through the inferior ſpecies, we ſhall find its manner of proceeding to be always the ſame. For every lower

(A) This account of the compoſition and reſolution of our ideas is agreeable to the common doctrine of logicians on the ſubject. Into the truth of the doctrine itſelf we ſhall inquire afterwards under the article METAPHYSICS: but to prevent miſtakes, it may be proper to obſerve here, that though every writer of logic has treated largely of *general* and *ſpecific ideas*, there is in reality nothing *general* in the matter but the *terms of language*. When we utter, for inſtance, the word *triangle*, that *general term* does not, as has been often ſaid, ſuggeſt to the mind the *general idea* of a triangle, which is neither *oblique* nor *rectangle*, neither *equilateral* nor *ſcalenon*, &c. for *ſuch* a triangle, as it cannot *exiſt* in *nature*, cannot be *conceived* in *idea*. In like manner, the *general term Virtue* does not excite a general *idea* of *virtue*, which is neither *prudence*, nor *temperance*, nor *fortitude*, nor *juſtice*, nor *charity*, &c. for that which is *diſtinct* from *all theſe* is not *virtue*. What then is the import of ſuch *general terms?* The anſwer is obvious: They denote *claſſes of objects*; and are never uſed without ſome word of limitation, but when ſomething that has no dependence upon the *particular qualities*, which diſtinguiſh the individuals from each other, is affirmed or denied of the whole claſs. Thus we may affirm, that the *three angles of a plain triangle are equal to two right angles:* and this propoſition is demonſtrably true, *not* of a triangle, which is neither *oblique* nor *rectangle*, neither *equilateral* nor *ſcalenon*, for ſuch a triangle never was conceived; but of *all theſe* triangles equally, as the truth of the propoſition and the progreſs of the demonſtration has no dependence upon the *peculiarities* which *diſtinguiſh* theſe triangles from one another. Again, when we ſay that *a man of virtue will be rewarded by God*, we do not mean by the word *virtue* a *general idea* making part of each of the complex and more *particular* ideas of *prudence*, *fortitude*, *juſtice*, &c. and at the ſame time *different* from them all; but we affirm, that the man who practiſes *any* or *all* of theſe virtues, according as he has opportunity, will be rewarded by God.

The hiſtory of our ideas is ſhortly this:—That act of the mind, if it may be called an *act*, which makes known an *external object*, is termed PERCEPTION. That act of the mind which makes known an *internal object*, is termed CONSCIOUSNESS. Objects once perceived may be recalled to the mind by the power of *memory*; and when they are ſo recalled, we have a perception of them in all reſpects ſimilar to the original perception, only leſs diſtinct; we fancy *ourſelves* in the *ſame place*, and the *object perceived* attended by the *ſame circumſtances*. This indiſtinct *ſecondary perception* of an object is termed an IDEA; and therefore the preciſe and accurate definition of an *idea*, in contradiſtinction to an *original perception*, is "that perception of a real object which is raiſed in the mind by the power of memory." Now all our *original perceptions* being of *particular objects*, it is obvious that our *ideas*, which are only thoſe perceptions recalled, muſt be of *particular objects likewiſe*, and that no man can have an *idea* of a thing of which the *real exiſtence* is contradictory and impoſſible. But the *general* and *ſpecific ideas* of logicians, are ideas of *nothing which exiſts*, or *which can poſſibly exiſt*. They are acquired, we are told, by *abſtraction*, in the following manner. Among a number of individuals we perceive certain qualities the ſame in all, whilſt in each individual there are other qualities which have nothing ſimilar to them in any other individual: now the mind, it is ſaid, has a power of abſtracting the *particular qualities* of *each individual* from *thoſe* which are *common to the whole*, and of theſe laſt forming a *general idea* of the whole claſs. Thus all men have nearly the *ſame form;* and they have each *ſome ſtature* and *ſome colour*, though there are not perhaps two individuals who have *preciſely the ſame ſtature* and the *ſame colour*. Now, ſay the advocates for general ideas, if we *abſtract* what is *peculiar* to *each individual*, and retain what is *common* to the *whole race*, we have the *general idea* ſignified by the word *man*. That is, if we conceive a being in human ſhape, which is of *ſtature* and *colour*, but neither *tall* nor *ſhort*, neither *white* nor *black*, nor *red* nor *brown*, nor *any other colour which we ever ſaw*, we have the *general idea* of *humanity*, and underſtand the meaning of the *word man!* Surely no perſon who is not the ſlave of prejudice will pretend that he can frame ſuch an idea as this—the idea of an object which cannot poſſibly exiſt in nature.

By this we do not mean to affirm, that we cannot frame ideas of ſuch objects as have *no real* exiſtence; for it is as eaſy to imagine a man with *ten heads* as *with one*, becauſe there is nothing contradictory between *ten heads* and *one body*. But *figure*, which is ſaid to be ſpace bounded *neither by lines nor ſuperficies; colour*, which is neither *red* nor *white*, nor *blue* nor *black*, &c.; and *animal*, which is neither *man*, *beaſt*, *bird*, nor *inſect*; are impoſſible in nature, and inconceivable in idea. There is, however, no harm in ſtill retaining the phraſe *general idea*, provided he who uſes it takes care to let it be known, that by theſe words he means not *any abſtract* and *contradictory idea*, but merely a *claſs* of *real objects*. The phraſe may at times prevent much circumlocution; for which reaſon we have retained the uſe of it in the text.

ſpecies is formed by ſuperadding ſome new idea to the ſpecies next above it; inſomuch that in this deſcending ſcale of our perceptions, the underſtanding paſſes through different orders of complex notions, which become more and more complicated at every ſtep it takes. Let us reſume here, for inſtance, the ſpecies of plain figures. They imply no more than ſpace bounded by lines. But if we take in an additional conſideration of the nature of theſe lines, as whether they are *right* or *curves*, we fall into the ſubdiviſions of plain figure, diſtinguiſhed by the names of *rectilinear*, *curvilinear*, and *mixtilinear*.

21 And in all the inferior ſpecies, by ſuperadding the ſpecific difference to the neareſt genus.

VII. And here we are to obſerve, that though plain figures, when conſidered as one of thoſe branches that come under the notion of figure in general, take the name of a ſpecies; yet compared with the claſſes of curvilinear, rectilinear, and mixtilinear, into which they themſelves may be divided, they really become a genus, of which the before mentioned ſubdiviſions conſtitute the ſeveral ſpecies. Theſe ſpecies, in the ſame manner as in the caſe of plain and ſolid figures, conſiſt of the genus and ſpecific difference as their conſtituent parts. For in the curvilinear kind, the curvity of the lines bounding the figure makes what is called the *ſpecific difference*; to which if we join the genus, which here is a plain figure or ſpace circumſcribed by lines, we have all that is neceſſary towards completing the notion of this ſpecies. We are only to take notice, that this laſt ſubdiviſion, having two genera above it, *viz.* plain figure, and figure in general; the genus joined with the ſpecific difference, in order to conſtitute the ſpecies of curvilinears, is that which lies neareſt to the ſaid ſpecies. It is the notion of plain figure, and not of figure in general, that, joined with the idea of curvity, makes up the complex conception of curve-lined figures. For in this deſcending ſcale of our ideas, figure in general, plain figures, curve-lined figures, the two firſt are conſidered as genera in reſpect of the third; and the ſecond in order, or that which ſtands next to the third, is called the *neareſt genus*. But now as it is this ſecond idea, which, joined with the notion of curvity, forms the ſpecies of curve-lined figures; it is plain, that the third or laſt idea in the ſeries is made up of the neareſt genus and ſpecific difference. This rule holds invariably, however far the ſeries is continued; becauſe, in a train of ideas thus ſucceeding one another, all that precede the laſt are conſidered as ſo many genera in reſpect of that laſt; and the laſt itſelf is always formed by ſuperadding the ſpecific difference to the genus next it.

22 The idea of any individual compoſed of the loweſt ſpecies and numeric difference.

VIII. Here then we have an univerſal deſcription, applicable to all our ideas of whatever kind, from the higheſt genus to the loweſt ſpecies. For, taking them in order downwards from the ſaid general idea, they every where conſiſt of the *genus proximum*, and *differentia ſpecifica*, as logicians love to expreſs themſelves. But when we come to the loweſt ſpecies of all, comprehending under it only individuals, the ſuperadded idea, by which theſe individuals are diſtinguiſhed one from another, no longer takes the name of the ſpecific difference. For here it ſerves not to denote diſtinct ſpecies, but merely a variety of individuals, each of which, having a particular exiſtence of its own, is therefore numerically different from every other of the ſame kind. And hence it is, that in this laſt caſe, logicians chooſe to call the ſuperadded idea by the name of the *numerical difference*; inſomuch that, as the idea of a ſpecies is made up of the neareſt genus and ſpecific difference, ſo the idea of an individual conſiſts of the loweſt ſpecies and numeric difference. Thus the circle is a ſpecies of curve-lined figures, and what we call the *loweſt ſpecies*, as comprehending under it only individuals. Circles in particular are diſtinguiſhed from one another by the length and poſition of their diameters. The length therefore and poſition of the diameter of a circle form what logicians call the *numerical difference*; becauſe, theſe being given, the circle itſelf may be deſcribed, and an individual thereby conſtituted.

23 Definitions to follow one another in train, and paſs thro' the ſame ſucceſſive gradations as our compound ideas.

IX. Thus the mind, in compounding its ideas, begins, we ſee, with the moſt general notions, which, conſiſting of but a few ſimple notices, are eaſily combined and brought together into one conception. Thence it proceeds to the ſpecies comprehended under this general idea, and theſe are formed by joining together the genus and ſpecific difference. And as it often happens, that theſe ſpecies may be ſtill farther ſubdivided, and run on in a long ſeries of continued gradations, producing various orders of compound perceptions; ſo all theſe ſeveral orders are regularly and ſucceſſively formed by annexing in every ſtep the ſpecific difference to the neareſt genus. When by this method of procedure we are come to the loweſt order of all, by joining the ſpecies and numeric difference, we frame the ideas of individuals. And here the ſeries neceſſarily terminates, becauſe it is impoſſible any farther to bound or limit our conceptions. This view of the compoſition of our ideas, repreſenting their conſtituent parts in every ſtep of the progreſſion, naturally points out the true and genuine form of a definition. For as definitions are no more than deſcriptions of the ideas for which the terms defined ſtand; and as ideas are then deſcribed, when we enumerate diſtinctly and in order the parts of which they conſiſt; it is plain, that by making our definitions follow one another according to the natural train of our conceptions, they will be ſubject to the ſame rules, and keep pace with the ideas they deſcribe.

24 The form of a definition in all the various orders of conception.

X. As therefore the firſt order of our compound notions, or the ideas that conſtitute the higheſt genera in the different ſcales of perception, are formed by uniting together a certain number of ſimple notices; ſo the terms expreſſing theſe genera are defined *by enumerating the ſimple notices ſo combined*. And as the ſpecies comprehended under any genus, or the complex ideas of the ſecond order, ariſe from ſuperadding the ſpecific difference to the ſaid general idea; ſo the definition of the names of the ſpecies is abſolved, in a detail of the ideas of the ſpecific difference, connected with the term of the genus. For the genus having been before defined, the term by which it is expreſſed ſtands for a known idea, and may therefore be introduced into all ſubſequent definitions, in the ſame manner as the names of ſimple perceptions. It will now be ſufficiently obvious, that the definitions of all the ſucceeding orders of compound notions will every where conſiſt of the term of the neareſt genus, joined with an enumeration of the ideas that conſtitute the

ſpecific

ſpecific difference; and that the definition of individuals unites the names of the loweſt ſpecies with the terms by which we expreſs the ideas of the numeric difference.

XI. Here then we have the true and proper form of a definition, in all the various orders of conception. This is that method of defining which is commonly called *logical*, and which we ſee is perfect in its kind, inaſmuch as it preſents a full and adequate deſcription of the idea for which the term defined ſtands.

PART II. OF JUDGMENT.

CHAP. I. *Of the Grounds of Human Judgment.*

25 Intuition reſpects the relations between our ideas when they are immediately perceivable.

THE mind being furniſhed with ideas, its next ſtep in the way to knowledge is, the comparing theſe ideas together, in order to judge of their agreement or diſagreement. In this joint view of our ideas, if the relation is ſuch as to be immediately diſcoverable by the bare inſpection of the mind, the judgments thence obtained are called *intuitive*, from a word that denotes *to look at*; for in this caſe, a mere attention to the ideas compared ſuffices to let us ſee how far they are connected or disjoined. Thus, *that the Whole is greater than any of its Parts*, is an intuitive judgement; nothing more being required to convince us of its truth, than an attention to the ideas of *whole* and *part*. And this too is the reaſon why we call the act of the mind forming theſe judgments *intuition*; as it is indeed no more than an immediate perception of the agreement or diſagreement of any two ideas.

26 Experience and teſtimony the ground of judging as to facts.

II. But here it is to be obſerved, that our knowledge of this kind reſpects only our ideas, and the relations between them; and therefore can ſerve only as a foundation to ſuch reaſonings as are employed in inveſtigating thoſe relations. Now it ſo happens, that many of our judgments are converſant about facts, and the real exiſtence of things, which cannot be traced by the bare contemplation of our ideas. It does not follow, becauſe I have the idea of a circle in my mind, that therefore a figure anſwering to that idea has a real exiſtence in nature. I can form to myſelf the notion of a centaur or golden mountain, but never imagine on that account that either of them exiſts. What then are the grounds of our judgment in relation to facts? *experience* and *teſtimony*. By experience we are informed of the exiſtence of the ſeveral objects which ſurround us, and operate upon our ſenſes. Teſtimony is of a wider extent, and reaches not only to objects beyond the preſent ſphere of our obſervation, but alſo to facts and tranſactions, which being now paſt, and having no longer any exiſtence, could not without this conveyance have fallen under our cognizance.

27 Three foundations of human judgment, *viz.* 1. Intuition, the ground of ſcientifical knowledge.

III. Here we have three foundations of human judgment, from which the whole ſyſtem of our knowledge may with eaſe and advantage be derived. Firſt, intuition, which reſpects our ideas themſelves, and their relations; and is the foundation of that ſpecies of reaſoning which we call *demonſtration*. For whatever is deduced from our intuitive perceptions, by a clear and connected ſeries of proofs, is ſaid to be demonſtrated, and produces abſolute certainty in the mind. Hence the knowledge obtained in this manner is what we properly term *ſcience*; becauſe in every ſtep of the procedure it carries its own evidence along with it, and leaves no room for doubt or heſitation. And what is highly worthy of notice; as the truths of this claſs expreſs the relation between our ideas, and the ſame relations muſt ever and invariably ſubſiſt between the ſame ideas, our deductions in the way of ſcience conſtitute what we call *eternal*, *neceſſary*, and *immutable truths*. If it be true that the whole is equal to all its parts, it muſt be ſo unchangeably; becauſe the relation of equality being attached to the ideas themſelves, muſt ever intervene where the ſame ideas are compared. Of this nature are all the truths of natural religion, morality, and mathematics, and in general whatever may be gathered from the bare view and conſideration of our ideas.

28 2. Experience, the ground of our knowledge of the powers and qualities of bodies.

IV. The ſecond ground of human judgment is *experience*; from which we infer the exiſtence of thoſe ſubjects that ſurround us, and fall under the immediate notice of our ſenſes. When we ſee the ſun, or caſt our eyes towards a building, we not only have perceptions of theſe objects within ourſelves, but aſcribe to them a real exiſtence out of the mind. It is alſo by the information of the ſenſes that we judge of the qualities of bodies; as when we ſay that *ſnow is white*, *fire hot*, or *ſteel hard*. For as we are wholly unacquainted with the internal ſtructure and conſtitution of the bodies that produce theſe ſenſations in us, nay, and are unable to trace any connection between that ſtructure and the ſenſations themſelves, it is evident, that we build our judgments altogether upon obſervation, aſcribing to bodies ſuch qualities as are anſwerable to the perceptions they excite in us. Not that we ever ſuppoſe the qualities of bodies to be things of the ſame nature with our perceptions; for there is nothing in fire ſimilar to our ſenſation of heat, or in a ſword ſimilar to pain: but that when different bodies excite in our minds ſimilar perceptions, we neceſſarily aſcribe to theſe bodies not only an exiſtence independent of us, but likewiſe ſimilar qualities, of which it is the nature to produce ſimilar perceptions in the human mind. But this is not the only advantage derived from experience; for to that too are we indebted for all our knowledge regarding the coexiſtence of ſenſible qualities in objects, and the operations of bodies one upon another. Ivory, for inſtance, is hard and elaſtic; this we know by experience, and indeed by that alone. For, being altogether ſtrangers to the true nature both of elaſticity and hardneſs, we cannot by the bare contemplation of our ideas determine how far the one neceſſarily implies the other, or whether there may not be a repugnance between them. But when we obſerve them to exiſt both in the ſame object, we are then aſſured from experience that they are not incompatible; and when we alſo find, that a ſtone is hard and not elaſtic, and that air though elaſtic is not hard, we alſo conclude upon the ſame foundation, that the ideas are not neceſſarily conjoined;

but may exiſt ſeparately in different objects. In like manner with regard to the operations of bodies one upon another, it is evident, that our knowledge this way is all derived from obſervation. *Aquaregia* diſſolves gold, as has been found by frequent trial, nor is there any other way of arriving at the diſcovery. Naturaliſts may tell us, if they pleaſe, that the parts of *aquaregia* are of a texture apt to inſinuate between the corpuſcles of gold, and thereby looſen and ſhake them aſunder. If this is a true account of the matter, it will notwithſtanding be allowed, that our conjecture in regard to the conformation of theſe bodies is deduced from the experiment, and not the experiment from the conjecture. It was not from any previous knowledge of the intimate ſtructure of *aquaregia* and *gold*, and the aptneſs of their parts to act or to be acted upon, that we came by the concluſion above mentioned. The internal conſtitution of bodies is in a manner wholly unknown to us; and could we even ſurmount this difficulty, yet as the ſeparation of the parts of gold implies ſomething like an active force in the *menſtruum*, and we are unable to conceive how it comes to be poſſeſſed of this activity, the effect muſt be owned to be altogether beyond our comprehenſion. But when repeated trials had once confirmed it, inſomuch that it was admitted as an eſtabliſhed truth in natural knowledge, it was then eaſy for men to ſpin out theories of their own invention, and contrive ſuch a ſtructure of parts, both for *gold* and *aquaregia*, as would beſt ſerve to explain the phenomenon upon the principles of that ſyſtem of philoſophy they had adopted.

V. From what has been ſaid it is evident, that as intuition is the foundation of what we call *ſcientifical* knowledge, ſo is experience of *natural*. For this laſt being wholly taken up with objects of ſenſe, or thoſe bodies that conſtitute the natural world; and their properties, as far as we can diſcover them, being to be traced only by a long and painful ſeries of obſervations; it is apparent, that, in order to improve this branch of knowledge, we muſt betake ourſelves to the method of trial and experiment.

VI. But though experience is what we may term the immediate foundation of natural knowledge, yet with reſpect to particular perſons its influence is very narrow and confined. The bodies that ſurround us are numerous, many of them lie at a great diſtance, and ſome quite beyond our reach. Life is ſo ſhort, and ſo crowded with cares, that but little time is left for any ſingle man to employ himſelf in unfolding the myſteries of nature. Hence it is neceſſary to admit many things upon the teſtimony of others, which by this means becomes the foundation of a great part of our knowledge of body. No man doubts of the power of *aquaregia* to diſſolve gold, though perhaps he never himſelf made the experiment. In theſe therefore and ſuch like caſes we judge of the facts and operations of nature upon the mere ground of teſtimony. However, as we can always have recourſe to experience where any doubt or ſcruple ariſes, this is juſtly conſidered as the true foundation of natural philoſophy; being indeed the ultimate ſupport upon which our aſſent reſts, and whereto we appeal when the higheſt degree of evidence is required.

VII. But there are many facts that will not allow of an appeal to the ſenſes; and in this caſe teſtimony is the true and only foundation of our judgments. All human actions of whatever kind, when conſidered as already paſt, are of the nature here deſcribed; becauſe having now no longer any exiſtence, both the facts themſelves, and the circumſtances attending them, can be known only from the relations of ſuch as had ſufficient opportunities of arriving at the truth. *Teſtimony* therefore is juſtly accounted a third ground of human judgment; and as from the other two we have deduced *ſcientifical* and *natural* knowledge, ſo we may from this derive *hiſtorical*; by which we mean, not merely a knowledge of the civil tranſactions of ſtates and kingdoms, but of all facts whatſoever, where teſtimony is the ultimate foundation of our belief.

29 3. Teſtimony, the ground of hiſtorical knowledge.

CHAP. II. *Of Affirmative and Negative Propoſitions.*

30 The ſubject and predicate of a propoſition explained.

I. WHILE the comparing of our ideas is conſidered merely as an act of the mind, aſſembling them together, and joining or disjoining them according to the reſult of its perceptions, we call it *judgment*; but when our judgments are put into words, they then bear the name of *propoſitions*. A propoſition therefore is a ſentence expreſſing ſome judgment of the mind, whereby two or more ideas are affirmed to agree or diſagree. Now, as our judgments include at leaſt two ideas, one of which is affirmed or denied of the other, ſo muſt a propoſition have terms anſwering to theſe ideas. The idea of which we affirm or deny, and of courſe the term expreſſing that idea, is called the *ſubject* of the propoſition. The idea affirmed or denied, as alſo the term anſwering it, is called the *predicate*. Thus in the propoſition, *God is omnipotent: God* is the ſubject, it being of him that we affirm omnipotence; and *omnipotent* is the predicate, becauſe we affirm the idea expreſſed by that word to belong to God.

31 The copula, &c.

II. But as, in propoſitions, ideas are either joined or disjoined; it is not enough to have terms expreſſing thoſe ideas, unleſs we have alſo ſome words to denote their agreement or diſagreement. That word in a propoſition, which connects two ideas together, is called the *copula*; and if a negative particle be annexed, we thereby underſtand that the ideas are diſjoined. The *ſubſtantive verb* is commonly made uſe of for the copula: as in the above-mentioned propoſition, *God is omnipotent*; where *is* repreſents the copula, and ſignifies the agreement of the ideas of *God* and *omnipotence*. But if we mean to ſeparate two ideas; then, beſides the ſubſtantive verb, we muſt alſo uſe ſome particle of negation, to expreſs this repugnance. The propoſition, *man is not perfect*, may ſerve as an example of this kind; where the notion of *perfection* being removed from the idea of *man*, the negative particle *not* is inſerted after the copula, to ſignify the diſagreement between the ſubject and predicate.

32 Propoſitions ſometimes expreſſed by a ſingle word.

III. Every propoſition neceſſarily conſiſts of theſe three parts: but then it is not alike needful that they be all ſeverally expreſſed in words; becauſe the copula is often included in the term of the predicate, as when we ſay, *he ſits*; which imports the ſame as *he is ſitting*. In the Latin language, a ſingle word has often the force of a whole ſentence. Thus *ambulat* is the ſame as *ille eſt ambulans*; *amo*, as *ego ſum amans*; and ſo in innumerable

innumerable other inſtances: by which it appears, that we are not ſo much to regard the number of words in a ſentence, as the ideas they repreſent, and the manner in which they are put together. For wherever two ideas are joined or disjoined in an expreſſion, tho' of but a ſingle word; it is evident that we have a ſubject, predicate, and copula, and of conſequence a complete propoſition.

33 Affirmative and negative propoſitions.

IV. When the mind joins two ideas, we call it an *affirmative* judgment; when it ſeparates them, *a negative:* and as any two ideas compared together muſt neceſſarily either agree or not agree, it is evident that all our judgments fall under theſe two diviſions. Hence likewiſe the propoſitions expreſſing theſe judgments are all either affirmative or negative. An affirmative propoſition connects the predicate with the ſubject, as *a ſtone is heavy;* a negative propoſition ſeparates them, as *God is not the author of evil. Affirmation* therefore is the ſame as joining two ideas together, and this is done by means of the copula. *Negation* on the contrary marks a repugnance between the ideas compared; in which caſe a negative particle muſt be called in, to ſhow that the connection included in the copula does not take place.

34 When the negative particle ſerves to disjoin ideas.

V. Hence we ſee the reaſon of the rule commonly laid down by logicians, That in all negative propoſitions the negation ought to affect the copula. For as the copula, when placed by itſelf, between the ſubject and the predicate, manifeſtly binds them together; it is evident, that in order to render a propoſition negative, the particles of negation muſt enter it in ſuch a manner as to deſtroy this union. In a word, then only are two ideas disjoined in a propoſition, when the negative particle may be ſo referred to the copula, as to break the affirmation included in it, and undo that connection it would otherwiſe eſtabliſh. When we ſay, for inſtance, *No man is perfect;* take away the negation, and the copula of itſelf plainly unites the ideas in the propoſition. But as this is the very reverſe of what is intended, a negative mark is added, to ſhow that this union does not here take place. The negation, therefore, by deſtroying the effect of the copula, changes the very nature of the propoſition, inſomuch that, inſtead of binding two ideas together, it denotes their ſeparation. On the contrary, in this ſentence, *The man who departs not from an upright behaviour is beloved of God,* the predicate *beloved of God* is evidently affirmed of the ſubject an *upright man;* ſo that, notwithſtanding the negative particle, the propoſition is ſtill affirmative. The reaſon is plain: the negation here affects not the copula; but, making properly a part of the ſubject, ſerves, with other terms in the ſentence, to form one complex idea, of which the predicate *beloved of God* is directly affirmed.

CHAP. III. *Of Univerſal and Particular Propoſitions.*

I. THE next conſiderable diviſion of propoſitions is into *univerſal* and *particular*. Our ideas, according to what has been already obſerved in the Firſt Part, are all ſingular as they enter the mind, and repreſent individual objects. But as by abſtraction we can render them univerſal, ſo as to comprehend a whole claſs of things, and ſometimes ſeveral claſſes at once; hence the terms expreſſing theſe ideas muſt be in like manner univerſal. If therefore we ſuppoſe any general term to become the ſubject of a propoſition, it is evident, that whatever is affirmed of the abſtract idea belonging to that term, may be affirmed of all the individuals to which that idea extends. Thus, when we ſay, *Men are mortal;* we conſider mortality, not as confined to one or any number of particular men, but as what may be affirmed without reſtriction of the whole ſpecies. By this means the propoſition becomes as general as the idea which makes the ſubject of it; and indeed derives its univerſality entirely from that idea, being more or leſs ſo according as this may be extended to more or fewer individuals. But it is further to be obſerved of theſe general terms, that they ſometimes enter a propoſition in their full latitude, as in the example given above; and ſometimes appear with a mark of limitation. In this laſt caſe we are given to underſtand, that the predicate agrees not to the whole univerſal idea, but only to a part of it; as in the propoſition, *Some men are wiſe:* For here wiſdom is not affirmed of every particular man, but reſtrained to a few of the human ſpecies (B).

35 Diviſion of propoſitions into univerſal and particular.

36 Propoſitions univerſal where the ſubject is ſo, without a mark of reſtriction.

II. Now from this different appearance of the general idea that conſtitutes the ſubject of any judgement, ariſes the diviſion of propoſitions into *univerſal* and *particular*. An univerſal propoſition is that wherein the ſubject is ſome general term taken in its full latitude; inſomuch that the predicate agrees to all the individuals comprehended under it, if it denotes a proper ſpecies; and to all the ſeveral ſpecies, and their individuals, if it marks an idea of a higher order. The words *all, every, no, none,* &c. are the proper ſigns of this univerſality; and as they ſeldom fail to accompany general truths, ſo they are the moſt obvious criterion whereby to diſtinguiſh them. *All animals have a power of beginning motion.* This is an univerſal propoſition; as we know from the word *all* prefixed to the ſubject *animals*, which denotes that it muſt be taken in its full extent. Hence the power of beginning motion may be affirmed of all the ſeveral ſpecies of animals.

37 Propoſitions particular where ſome univerſal ſubject appears with a mark of limitation.

III. A *particular* propoſition has in like manner ſome general term for its ſubject; but with a mark of limitation added, to denote, that the predicate agrees only to ſome of the individuals comprehended under a ſpecies, or to one or more of the ſpecies belonging to any genus, and not to the whole univerſal idea. Thus, *Some ſtones are heavier than iron: Some men have an uncommon ſhare of prudence.* In the laſt of theſe propoſitions, the ſubject *ſome men* implies only a certain number

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(B) See the preceding note, where it is demonſtrated that the *terms* alone, and not the *ideas*, are in reality *general*. The term *man* is equally applicable to every individual of the human race; and therefore, what is affirmed or denied of *men* in general, is affirmed or denied of all the individuals, without regard to their diſcriminating qualities. *Some* is a definitive word (ſee GRAMMAR), which, prefixed to the word *man*, limits the ſignification of that *general term;* and therefore what is affirmed of *ſome men*, is affirmed only of *part* of the race, but that part itſelf is not aſcertained.

ber of individuals, comprehended under a ſingle ſpecies. In the former, where the ſubject is a genus that extends to a great variety of diſtinct claſſes, *ſome ſtones* may not only imply any number of particular ſtones, but alſo ſeveral whole ſpecies of ſtones, inaſmuch as there may be not a few with the property there deſcribed. Hence we ſee, that a propoſition does not ceaſe to be particular by the predicate's agreeing to a whole ſpecies, unleſs that ſpecies, ſingly and diſtinctly conſidered, makes alſo the ſubject of which we affirm or deny.

38 Singular propoſitions contained under the head of particulars.

IV. There is ſtill one ſpecies of propoſitions that remains to be deſcribed, and which the more deſerves our notice, as it is not yet agreed among logicians to which of the two claſſes mentioned above they ought to be referred; namely, *ſingular* propoſitions, or thoſe where the ſubject is an individual. Of this nature are the following: *Sir Iſaac Newton was the inventor of fluxions; This book contains many uſeful truths.* What occaſions ſome difficulty as to the proper rank of theſe propoſitions is, that, the ſubject being taken according to the whole of its extenſion, they ſometimes have the ſame effect in reaſoning as univerſals. But if it be conſidered that they are in truth the moſt limited kind of particular propoſitions, and that no propoſition can with any propriety be called univerſal but where the ſubject is ſome univerſal idea; we ſhall not be long in determining to which claſs they ought to be referred. When we ſay, *Some books contain uſeful truths;* the propoſition is particular, becauſe the general term appears with a mark of reſtriction. If therefore we ſay, *This book contains uſeful truths;* it is evident that the propoſition muſt be ſtill more particular, as the limitation implied in the word *this* is of a more confined nature than in the former caſe.

39 The fourfold diviſion of propoſitions.

V. We ſee, therefore, that all propoſitions are either *affirmative* or *negative;* nor is it leſs evident, that in both caſes they may be *univerſal* or *particular*. Hence ariſes that celebrated fourfold diviſion of them into *univerſal affirmative* and *univerſal negative*, *particular affirmative* and *particular negative*, which comprehends indeed all their varieties. The uſe of this method of diſtinguiſhing them will appear more fully afterwards, when we come to treat of reaſoning and ſyllogiſm.

CHAP. IV. *Of Abſolute and Conditional Propoſitions.*

40 Diſtinction of qualities into eſſential and accidental.

I. THE objects about which we are chiefly converſant in this world, are all of a nature liable to change. What may be affirmed of them at one time, cannot often at another; and it makes no ſmall part of our knowledge to diſtinguiſh rightly theſe variations, and trace the reaſons upon which they depend. For it is obſervable, that amidſt all the viciſſitude of nature, ſome things remain conſtant and invariable; nor even are the changes, to which we ſee others liable, effected but in conſequence of uniform and ſteady laws, which, when known, are ſufficient to direct us in our judgments about them. Hence philoſophers, in diſtinguiſhing the objects of our perception into various claſſes, have been very careful to note, that ſome properties belong eſſentially to the general idea, ſo as not to be ſeparable from it but by deſtroying its very nature; while others are only accidental, and may be affirmed or denied of it in different circumſtances. Thus ſolidity, a yellow colour, and great weight, are conſidered as eſſential qualities of gold; but whether it ſhall exiſt as an uniform conjoined maſs, is not alike neceſſary. We ſee that by a proper menſtruum it may be reduced to a fine powder, and that an intenſe heat will bring it into a ſtate of fuſion.

41 Hence a conſiderable diverſity in our manner of judging.

II. From this diverſity in the ſeveral qualities of things ariſes a conſiderable difference as to the manner of our judging about them. For all ſuch properties as are inſeparable from objects when conſidered as belonging to any genus or ſpecies, are affirmed abſolutely and without reſerve of that general idea. Thus we ſay, *Gold is very weighty; A ſtone is hard; Animals have a power of ſelf-motion.* But in the caſe of mutual or accidental qualities, as they depend upon ſome other conſideration diſtinct from the general idea; that alſo muſt be taken into the account, in order to form an accurate judgment. Should we affirm, for inſtance, of ſome ſtones, that they are very ſuſceptible of a rolling motion; the propoſition, while it remains in this general form, cannot with any advantage be introduced into our reaſonings. An aptneſs to receive that mode of motion flows from the figure of the ſtone; which, as it may vary infinitely, our judgment then only becomes applicable and determinate, when the particular figure, of which volubility is a conſequence, is alſo taken into the account. Let us then bring in this other conſideration, and the propoſition will run as follows: *Stones of a ſpherical form are eaſily put into a rolling motion.* Here we ſee the condition upon which the predicate is affirmed, and therefore know in what particular caſes the propoſition may be applied.

42 Which gives riſe to the diviſion of propoſitions into abſolute and conditional.

III. This conſideration of propoſitions reſpecting the manner in which the predicate is affirmed of the ſubject gives riſe to the diviſion of them into *abſolute* and *conditional*. *Abſolute* propoſitions are thoſe wherein we affirm ſome property inſeparable from the idea of the ſubject, and which therefore belongs to it in all poſſible caſes: as, *God is infinitely wiſe; Virtue tends to the ultimate happineſs of man.* But where the predicate is not neceſſarily connected with the idea of the ſubject, unleſs upon ſome conſideration diſtinct from that idea, there the propoſition is called *conditional*. The reaſon of the name is taken from the ſuppoſition annexed, which is of the nature of a condition, and may be expreſſed as ſuch, thus: *If a ſtone is expoſed to the rays of the ſun, it will contract ſome degree of heat; If a river runs in a very declining channel, its rapidity will conſtantly increaſe.*

43 The great importance of this diviſion, as it renders propoſitions determinate.

IV. There is not any thing of greater importance in philoſophy than a due attention to this diviſion of propoſitions. If we are careful never to affirm things abſolutely but where the ideas are inſeparably conjoined; and if in our other judgments we diſtinctly mark the conditions which determine the predicate to belong to the ſubject; we ſhall be the leſs liable to miſtake in applying general truths to the particular concerns of human life. It is owing to the exact obſervance of this rule that mathematicians have been ſo happy in their diſcoveries, and that what they demonſtrate of magnitude in general may be applied with eaſe in all obvious occurrences.

V. The truth of it is, particular propoſitions are then known to be true, when we can trace their connection

44 And reduces them from particulars to generals.

nection with universals; and it is accordingly the great business of science to find out general truths that may be applied with safety in all obvious instances. Now the great advantage arising from determining with care the conditions upon which one idea may be affirmed or denied of another is this: that thereby particular propositions really become universal, may be introduced with certainty into our reasonings, and serve as standards to conduct and regulate our judgements. To illustrate this by a familiar instance: if we say, *Some water acts very forcibly;* the proposition is particular: and as the conditions on which this forcible action depends are not mentioned, it is as yet uncertain in what cases it may be applied. Let us then supply these conditions, and the proposition will run thus: *Water conveyed in sufficient quantity along a steep descent acts very forcibly.* Here we have an universal judgment, inasmuch as the predicate *forcible action* may be ascribed to all water under the circumstances mentioned. Nor is it less evident that the proposition in this new form is of easy application; and in fact we find that men do apply it in instances where the forcible action of water is required; as in corn-mills and many other works of art.

CHAP. V. *Of Simple and Compound Propositions.*

45 Division of propositions into simple and compound.

I. HITHERTO we have treated of propositions, where only two ideas are compared together. These are in the general called *simple;* because, having but one subject and one predicate, they are the effect of a simple judgment that admits of no subdivision. But if it so happens that several ideas offer themselves to our thoughts at once, whereby we are led to affirm the same thing of different objects, or different things of the same object; the propositions expressing these judgments are called *compound:* because they may be resolved into as many others as there are subjects or predicates in the whole complex determination on the mind. Thus, *God is infinitely wise and infinitely powerful.* Here there are two predicates, *infinite wisdom and infinite power,* both affirmed of the same subject; and accordingly the proposition may be resolved into two others, affirming these predicates severally. In like manner in the proposition, *Neither kings nor people are exempt from death;* the predicate is denied of both subjects, and may therefore be separated from them in distinct propositions. Nor is it less evident, that if a complex judgment consists of several subjects and predicates, it may be resolved into as many simple propositions as are the number of different ideas compared together. *Riches and honours are apt to elate the mind, and increase the number of our desires.* In this judgment there are two subjects and two predicates, and it is at the same time apparent that it may be resolved into four distinct propositions. *Riches are apt to elate the mind. Riches are apt to increase the number of our desires.* And so of honours.

46 The proper notion of a compound proposition ascertained.

II. Logicians have divided these compound propositions into a great many different classes; but, in our opinion, not with a due regard to their proper definition. Thus *conditionals, causals, relatives,* &c. are mentioned as so many distinct species of this kind, though in fact they are no more than simple propositions. To give an instance of a conditional; *If a stone is exposed to the rays of the sun, it will contract some degree of heat.* Here we have but one subject and one predicate; for the complex expression, *A stone exposed to the rays of the sun,* constitutes the proper subject of this proposition, and is no more than one determined idea. The same thing happens in causals. *Rehoboam was unhappy because he followed evil counsel.* There is here an appearance of two propositions arising from the complexity of the expression; but when we come to consider the matter more nearly, it is evident that we have but a single subject and predicate. *The pursuit of evil counsel brought misery upon Rehoboam.* It is not enough, therefore, to render a proposition compound, that the subject and predicate are complex notions, requiring sometimes a whole sentence to express them: for in this case the comparison is still confined to two ideas, and constitutes what we call a simple judgment. But where there are several subjects or predicates, or both, as the affirmation or negation may be alike extended to them all, the proposition expressing such a judgment is truly a collection of as many simple ones as there are different ideas compared. Confining ourselves therefore to this more strict and just notion of compound propositions, they are all reducible to two kinds, viz. *copulatives* and *disjunctives.*

47 Compound propositions, either copulative:

III. A *copulative* proposition is, where the subjects and predicates are so linked together, that they may be all severally affirmed or denied one of another. Of this nature are the examples of compound propositions given above. *Riches and honours are apt to elate the mind, and increase the number of our desires. Neither kings nor people are exempt from death.* In the first of these the two predicates may be affirmed severally of each subject, whence we have four distinct propositions. The other furnishes an example of the negative kind, where the same predicate, being disjoined from both subjects, may be also denied of them in separate propositions.

48 Or disjunctive.

IV. The other species of compound propositions are those called disjunctives; in which, comparing several predicates with the same subject; we affirm that one of them necessarily belongs to it, but leave the particular predicate undetermined. If any one, for example, says, *This world either exists of itself, of is the work of some all-wise and powerful cause,* it is evident that one of the two predicates must belong to the world; but as the proposition determines not which, it is therefore of the kind we call *disjunctive.* Such too are the following: *The sun either moves round the earth, or is the centre about which the earth revolves. Friendship finds men equal, or makes them so.* It is the nature of all propositions of this class, supposing them to be exact in point of form, that upon determining the particular predicate, the rest are of course to be removed; or if all the predicates but one are removed, that one necessarily takes place. Thus, in the example given above; if we allow the world to be the work of some wise and powerful cause, we of course deny it to be self-existent; or if we deny it to be self-existent, we must necessarily admit that it was produced by some wise and powerful cause. Now this particular manner of linking the predicates together, so that the establishing one displaces all the rest; or the excluding all but one necessarily establishes that one; cannot otherwise be effected than by means of *dis-*

junctive particles. And hence it is that propoſitions of this claſs take their names from theſe particles which make ſo neceſſary a part of them, and indeed conſtitute their very nature conſidered as a diſtinct ſpecies.

Chap VI. *Of the Diviſion of Propoſitions into Self-evident and Demonſtrable.*

49 Propoſitions divided into ſelf-evident and demonſtrable.

I. When any propoſition is offered to the view of the mind, if the terms in which it is expreſſed be underſtood; upon comparing the ideas together, the agreement or diſagreement aſſerted is either immediately perceived, or found to lie beyond the preſent reach of the underſtanding. In the firſt caſe the propoſition is ſaid to be *ſelf-evident*, and admits not of any proof, becauſe a bare attention to the ideas themſelves produces full conviction and certainty; nor is it poſſible to call in any thing more evident by way of confirmation. But where the connection or repugnance comes not ſo readily under the inſpection of the mind, there we muſt have recourſe to reaſoning; and if by a clear ſeries of proofs we can make out the truth propoſed, inſomuch that ſelf-evidence ſhall accompany every ſtep of the procedure, we are then able to demonſtrate what we aſſert, and the propoſition itſelf is ſaid to be *demonſtrable*. When we affirm, for inſtance, *that it is impoſſible for the ſame thing to be and not to be;* whoever underſtands the terms made uſe of perceives at firſt glance the truth of what is aſſerted, nor can he by any efforts bring himſelf to believe the contrary. The propoſition therefore is *ſelf-evident*, and ſuch that it is impoſſioble by reaſoning to make it plainer; becauſe there is no truth more obvious or better known, from which as a conſequence it may be deduced. But if we ſay, *This world had a beginning;* the aſſertion is indeed equally true, but ſhines not forth with the ſame degree of evidence. We find great difficulty in conceiving how the world could be made out of nothing: and are not brought to a free and full conſent, until by reaſoning we arrive at a clear view of the abſurdity involved in the contrary ſuppoſition. Hence this propoſition is of the kind we call *demonſtrable*, inaſmuch as its truth is not immediately perceived by the mind, but yet may be made appear by means of others more known and obvious, whence it follows as an unavoidable conſequence.

II. From what has been ſaid, it appears, that reaſoning is employed only about demonſtrable propoſitions, and that our intuitive and ſelf-evident perceptions are the ultimate foundation on which it reſts.

50 Self-evident truths the firſt principles of reaſoning

III. Self-evident propoſitions furniſh the firſt principles of reaſoning; and it is certain, that if in our reſearches we employ only ſuch principles as have this character of ſelf-evidence, and apply them according to the rules to be afterwards explained, we ſhall be in no danger of error in advancing from one diſcovery to another. For this we may appeal to the writings of the mathematicians, which being conducted by the expreſs model here mentioned, are an inconteſtable proof of the firmneſs and ſtability of human knowledge, when built upon ſo ſure a foundation. For not only have the propoſitions of this ſcience ſtood the teſt of ages; but are found attended with that invincible evidence, as forces the aſſent of all who duly conſider the proofs upon which they are eſtabliſhed. Since the mathematicians are univerſally allowed to have hit upon the right method of arriving at unknown truths, ſince they have been the happieſt in the choice as well as the application of their principles, it may not be amiſs to explain here their method of ſtating ſelf-evident propoſitions, and applying them to the purpoſes of demonſtration.

51 Definitions a great help to clearneſs and evidence in knowledge.

IV. Firſt then it is to be obſerved, that they have been very careful in aſcertaining their ideas, and fixing the ſignfication of their terms. For this purpoſe they begin with *definitions*, in which the meaning of their words is ſo diſtinctly explained, that they cannot fail to excite in the mind of an attentive reader the very ſame ideas as are annexed to them by the writer. And indeed the clearneſs and irreſiſtible evidence of mathematical knowledge is owing to nothing ſo much as this care in laying the foundation. Where the relation between any two ideas is accurately and juſtly traced, it will not be difficult for another to comprehend that relation, if in ſetting himſelf to diſcover it he brings the very ſame ideas into compariſon. But if, on the contrary, he affixes to his words ideas different from thoſe that were in the mind of him who firſt advanced the demonſtration; it is evident, that as the ſame ideas are not compared, the ſame relation cannot ſubſiſt, inſomuch that a propoſition will be rejected as falſe, which, had the terms been rightly underſtood, muſt have appeared inconteſtably true. A ſquare, for inſtance, is a figure bounded by four equal right lines, joined together at right angles. Here the nature of the angles makes no leſs a part of the idea than the equality of the ſides; and many properties demonſtrated of the ſquare flow entirely from its being a rectangular figure. If therefore we ſuppoſe a man, who has formed a partial notion of a ſquare, comprehending only the equality of its ſides, without regard to the angles, reading ſome demonſtration that implies alſo this latter conſideration; it is plain he would reject it as not univerſally true, inaſmuch as it could not be applied where the ſides were joined together at equal angles. For this laſt figure, anſwering ſtill to his idea of a ſquare, would be yet found without the property aſſigned to it in the propoſition. But if he comes afterwards to corrrect his notion, and render his idea complete, he will then readily own the truth and juſtneſs of the demonſtration.

52 Mathematicians, by beginning with them, procure a ready reception to the truths they advance.

V. We ſee, therefore, that nothing contributes ſo much to the improvement and certainty of human knowledge, as the having determinate ideas, and keeping them ſteady and invariable in all our diſcourſes and reaſonings about them. And on this account it is, that mathematicians, as was before obſerved, always begin by defining their terms, and diſtinctly unfolding the notions they are intended to expreſs. Hence ſuch as apply themſelves to theſe ſtudies have exactly the ſame views of things; and, bringing always the very ſame ideas into compariſon, readily diſcern the relations between them. It is likewiſe of importance, in every demonſtration, to expreſs the ſame *idea* invariably by the ſame word. From this practice mathematicians never deviate; and if it be neceſſary in their demonſtrations, where the reader's comprehenſion is *aided* by a diogram, it is much more ſo in all reaſonings about moral or intellectual truths where the ideas

cannot

cannot be repreſented by a diagram. The obſervation of this rule may ſometimes be productive of ill-ſounding periods; but when *truth* is the object, *ſound* ought to be deſpiſed.

53 The eſtabliſhing of principles, the ſecond ſtep in mathematical knowledge.

VI. When the mathematicians have taken this firſt ſtep, and made known the ideas whoſe relations they intend to inveſtigate; their next care is, to lay down ſome ſelf-evident truths, which may ſerve as a foundation for their future reaſonings. And here indeed they proceed with remarkable circumſpection, admitting no principles but what flow immediately from their definitions, and neceſſarily force themſelves upon a mind in any degree attentive to its ideas. Thus a *circle* is a figure formed by a right line moving round ſome fixed point in the ſame plane. The fixed point round which the line is ſuppoſed to move, and where one of its extremities terminates, is called the *centre* of the circle. The other extremity, which is conceived to be carried round until it returns to the point whence it firſt ſet out, deſcribes a curve running into itſelf, and termed the *circumference*. All right lines drawn from the centre to the circumference are called *radii*. From theſe definitions compared, geometricians derive this ſelf-evident truth; *that the radii of the ſame circle are all equal to one another*.

54 Propoſitions divided into ſpeculative and practical.

VII. We now obſerve, that in all propoſitions we either affirm or deny ſome property of the idea that conſtitutes the ſubject of our judgment, or we maintain that ſomething may be done or effected. The firſt ſort are called *ſpeculative* propoſitions, as in the example mentioned above, the *radii of the ſame circle are all equal one to another*. The others are called *practical*, for a reaſon too obvious to be mentioned; thus, *that a right line may be drawn from one point to another* is a practical propoſition; inaſmuch as it expreſſes that ſomething may be done.

55 Hence mathematical principles diſtinguiſhed into axioms and poſtulates.

VIII. From this twofold conſideration of propoſitions ariſes the twofold diviſion of mathematical principles into axioms and poſtulates. By an *axiom* they underſtand any ſelf-evident ſpeculative truth; as, *That the whole is greater than its parts: That things equal to one and the ſame thing are equal to one another*. But a ſelf-evident practical propoſition is what they call a *poſtulate*. Such are thoſe of Euclid; *that a finite right line may by continued directly forwards; that a circle may be deſcribed about any centre with any diſtance*. And here we are to obſerve, that as in an axiom the agreement or diſagreemeent between the ſubject and predicate muſt come under the immediate inſpection of the mind; ſo in a poſtulate, not only the poſſibility of the thing aſſerted muſt be evident at firſt view, but alſo the manner in which it may be effected. For where this manner is not of itſelf apparent, the propoſition comes under the notion of the demonſtrable kind, and is treated as ſuch by geometrical writers. Thus, *to draw a right line from one point to another*, is aſſumed by Euclid as a poſtulate, becauſe the manner of doing it is ſo obvious, as to require no previous teaching. But then it is not equally evident, how we are to conſtruct an equilateral triangle. For this reaſon he advances it as a demonſtrable propoſition, lays down rules for the exact performance, and at the ſame time proves, that if theſe rules are followed, the figure will be juſtly deſcribed.

56 And demonſtrable propoſitions into theorems and problems.

IX. This leads us to take notice, that as ſelf-evident truths are diſtinguiſhed into different kinds, according as they are ſpeculative or practical; ſo is it alſo with demonſtrable propoſitions. A demonſtrable ſpeculative propoſition is by mathematicians called a *theorem*. Such is the famous 47th propoſition of the firſt book of the elements, known by the name of the *Pythagoric theorem*, from its ſuppoſed inventor Pythagoras, viz. "that in every right-angled triangle, the ſquare deſcribed upon the ſide ſubtending the right-angle is equal to both the ſquares deſcribed upon the ſides containing the right-angle." On the other hand, a demonſtrable practical propoſition is called a *problem*; as where Euclid teaches us to deſcribe a ſquare upon a given right-line.

57 Corollaries are obvious deductions from theorems or problems.

X. It may not be amiſs to add, that, beſides the four kinds of propoſitions already mentioned, mathematicians have alſo a fifth, known by the name of *corollaries*. Theſe are uſually ſubjoined to theorems or problems, and differ from them only in this; that they flow from what is there demonſtrated in ſo obvious a manner as to diſcover their dependence upon the propoſition whence they are deduced, almoſt as ſoon as propoſed. Thus Euclid having demonſtrated, "that in every right-lined triangle all the three angles taken together are equal to two right-angles;" adds by way of corollary, "that all the three angles of any one triangle taken together are equal to all the three angles of any other triangle taken together:" which is evident at firſt ſight; becauſe in all caſes they are equal to two right ones, and things equal to one and the ſame thing are equal to one another.

58 Scholia ſerve the purpoſes of annotations or a comment.

XI. The ſcholia of mathematicians are indifferently annexed to definitions, propoſitions, or corollaries; and anſwer the ſame purpoſes as annotations upon a claſſic author. For in them occaſion is taken to explain whatever may appear intricate and obſcure in a train of reaſoning; to anſwer objections; to teach the application and uſes of propoſitions; to lay open the original and hiſtory of the ſeveral diſcoveries made in the ſcience; and, in a word, to acquaint us with all ſuch particulars as deſerve to be known, whether conſidered as points of curioſity or profit.

Part III. Of REASONING.

Chap. I. *Of Reaſoning in general, and the Parts of which it conſiſts.*

59 Remote relations diſcovered by means of intermediate ideas.

IT often happens in comparing ideas together, that their agreement or diſagreement cannot be diſcerned at firſt view, eſpecially if they are of ſuch a nature as not to admit of an exact application one to another. When, for inſtance, we compare two figures of a different make, in order to judge of their equality or inequality, it is plain, that by barely conſidering the figures themſelves, we cannot arrive at an exact determination; becauſe, by reaſon of their diſagreeing forms, it is impoſſible ſo to put them together, as that their ſeveral parts ſhall mutually coincide. Here then it becomes

comes neceſſary to look out for ſome third idea that will admit of ſuch an application as the preſent caſe requires; wherein if we ſucceed, all difficulties vaniſh, and the relation we are in queſt of may be traced with eaſe. Thus right-lined figures are all reduced to ſquares, by means of which we can meaſure their areas, and determine exactly their agreement or diſagreement in point of magnitude.

60 This manner of arriving at truth termed reaſoning.

II. But how can any third idea ſerve to diſcover a relation between two others? The anſwer is, By being compared ſeverally with theſe others; for ſuch a compariſon enables us to ſee how far the ideas with which this third is compared are connected or disjoined between themſelves. In the example mentioned above of two right-lined figures, if we compare each of them with ſome ſquare whoſe area is known, and find the one exactly equal to it, and the other leſs by a ſquare inch, we immediately conclude that the area of the firſt figure is a ſquare inch greater than that of the ſecond. This manner of determining the relation between any two ideas, by the intervention of ſome third with which they may be compared, is that which we call *reaſoning*; and is indeed the chief inſtrument by which we puſh on our diſcoveries, and enlarge our knowledge. The great art lies in finding out ſuch intermediate ideas, as, when compared with the others in the queſtion, will furniſh evident and known truths; becauſe, as will afterwards appear, it is only by means of them that we arrive at the knowledge of what is hidden and remote.

61 The parts that conſtitute an act of reaſoning and a ſyllogiſm.

III. Hence it appears, that every act of reaſoning neceſſarily includes three diſtinct judgments; two wherein the ideas whoſe relation we want to diſcover are ſeverally compared with the middle idea, and a third wherein they are themſelves connected or disjoined, according to the reſult of that compariſon. Now, as in the ſecond part of logic our judgments, when put into words, were called propoſitions, ſo here in the third part the expreſſions of our reaſonings are termed *ſyllogiſms*. And hence it follows, that as every act of reaſoning implies three ſeveral judgments, ſo every ſyllogiſm muſt include three diſtinct propoſitions. When a reaſoning is thus put into words, and appears in form of a ſyllogiſm, the intermediate idea made uſe of, to diſcover the agreement or diſagreement we ſearch for, is called the *middle term*; and the two ideas themſelves, with which this third is compared, go by the name of the *extremes*.

62 Inſtance, man and accountableneſs.

IV. But as theſe things are beſt illuſtrated by examples; let us, for inſtance, ſet ourſelves to inquire *whether men are accountable for their actions*. As the relation between the ideas of *man* and *accountableneſs* comes not within the immediate view of the mind, our firſt care muſt be to find out ſome third idea that will enable us the more eaſily to diſcover and trace it. A very ſmall meaſure of reflection is ſufficient to inform us, that no creature can be accountable for his actions, unleſs we ſuppoſe him capable of diſtinguiſhing the good from the bad; that is, unleſs we ſuppoſe him poſſeſſed of reaſon. Nor is this alone ſufficient. For what would it avail him to know good from bad actions, if he had no freedom of choice, nor could avoid the one and purſue the other? hence it becomes neceſſary to take in both conſiderations in the preſent caſe. It is at the ſame time equally apparent, that wherever there is this ability of diſtinguiſhing good from bad actions, and of purſuing the one and avoiding the other, there alſo a creature is accountable. We have then got a third idea, with which *accountableneſs* is inſeparably connected, viz. *reaſon and liberty*; which are here to be conſidered as making up one complex conception. Let us now take this middle idea, and compare it with the other term in the queſtion, viz. *man*, and we all know by experience that it may be affirmed of him. Having thus by means of the intermediate idea formed two ſeveral judgments, viz. *that man is poſſeſſed of reaſon and liberty*; and *that reaſon and liberty imply accountableneſs*; a third obviouſly and neceſſarily follows, viz. *that man is accountable for his actions*. Here then we have a complete act of reaſoning, in which, according to what has been already obſerved, there are three diſtinct judgments; two that may be ſtyled previous, inaſmuch as they lead to the other, and ariſe from comparing the middle idea with the two ideas in the queſtion: the third is a conſequence of theſe previous acts, and flows from combining the extreme ideas between themſelves. If now we put this reaſoning into words, it exhibits what logicians term a ſyllogiſm; and, when propoſed in due form, runs thus:

"Every creature poſſeſſed of reaſon and liberty is accountable for his actions.

"Man is a creature poſſeſſed of reaſon and liberty: Therefore man is accountable for his actions."

63 Premiſes, concluſion, extremes, middle term.

V. In this ſyllogiſm we may obſerve, that there are three ſeveral propoſitions expreſſing the three judgements implied in the act of reaſoning; and ſo diſpoſed, as to repreſent diſtinctly what paſſes within the mind in tracing the more diſtant relations of its ideas. The two firſt propoſitions anſwer the two previous judgments in reaſoning, and are called the *premiſes*, becauſe they are placed before the other. The third is termed the *concluſion*, as being gained in conſequence of what was aſſerted in the premiſes. We are alſo to remember, that the terms expreſſing the two ideas whoſe relations we enquire after, as here *man* and *accountableneſs*, are in general called the *extremes*; and that the intermediate idea, by means of which the relation is traced, viz. *a creature poſſeſſed of reaſon and liberty*, takes the name of the *middle term*. Hence it follows, that by the *premiſes* of a ſyllogiſm we are always to underſtand the two propoſitions where the middle term is ſeverally compared with the *extremes*; for theſe conſtitute the previous judgments, whence the truth we are in queſt of is by reaſoning deduced. The *concluſion* is that other propoſition, in which the *extremes* themſelves are joined or ſeparated agreeably to what appears upon the above compariſon.

64 Major and minor term, major and minor propoſition.

VI. The concluſion is made up of the extreme terms of the ſyllogiſm: and the extreme, which ſerves as the predicate of the concluſion, goes by the name of the *major term*: the other extreme, which makes the ſubject in the ſame propoſition, is called the *minor term*. From this diſtinction of the extremes ariſes alſo a diſtinction between the premiſes, where theſe extremes are ſeverally compared with the middle term. That propoſition which compares the greater extreme, or the predicate of the concluſion, with the middle term, is called the *major propoſition*: the other, wherein the ſame middle term is compared with the ſubject of the

conclusion or leſſer extreme, is called the *minor propoſition*. All this is obvious from the ſyllogiſm already given, where the concluſion is, *Man is accountable for his actions*. For here the predicate *accountable for his actions*, being connected with the middle term in the firſt of the two premiſes, *every creature poſſeſſed of reaſon and liberty is accountable for his actions*, gives what we call the *major propoſition*. In the ſecond of the premiſes, *man is a creature poſſeſſed of reaſon and liberty*, we find the leſſer extreme, or ſubject of the concluſion, viz. *man*, connected with the ſame middle term, whence it is known to be the *minor propoſition*. When a ſyllogiſm is propoſed in due form, the major propoſition is always placed firſt, the minor next, and the concluſion laſt.

65 In a ſingle act of reaſoning the premiſes muſt be intuitive truths.

VII. Theſe things premiſed, we may in the general define reaſoning to be an act or operation of the mind, deducing ſome unknown propoſition from other previous ones that are evident and known. Theſe previous propoſitions, in a ſimple act of reaſoning, are only two in number; and it is always required that they be of themſelves apparent to the underſtanding, inſomuch that we aſſent to and perceive the truth of them as ſoon as propoſed. In the ſyllogiſm given above, the premiſes are ſuppoſed to be ſelf-evident truths; otherwiſe the concluſion could not be inferred by a ſingle act of reaſoning. If, for inſtance, in the major, *every creature poſſeſſed of reaſon and liberty is accountable for his actions*, the connection between the ſubject and predicate could not be perceived by a bare attention to the ideas themſelves; it is evident that this propoſition would no leſs require a proof than the concluſion deduced from it. In this caſe a new middle term muſt be ſought for, to trace the connection here ſuppoſed; and this of courſe furniſhes another ſyllogiſm, by which having eſtabliſhed the propoſition in queſtion, we are then, and not before, at liberty to uſe it in any ſucceeding train of reaſoning. And ſhould it ſo happen, that in this ſecond eſſay there was ſtill ſome previous propoſition whoſe truth did not appear at firſt ſight, we muſt then have recourſe to a third ſyllogiſm, in order to lay open that truth to the mind: becauſe ſo long as the premiſes remain uncertain, the concluſion built upon them muſt be ſo too. When, by conducting our thoughts in this manner, we at laſt arrive at ſome ſyllogiſm where the previous propoſitions are intuitive truths; the mind then reſts in full ſecurity, as perceiving that the ſeveral concluſions it has paſſed through ſtand upon the immoveable foundation of ſelf-evidence, and when traced to their ſource terminate in it.

66 Reaſoning, in the higheſt exerciſe of it, only a concatenation of ſyllogiſms.

VIII. We ſee, therefore, that in order to infer a concluſion by a ſingle act of reaſoning, the premiſes muſt be intuitive propoſitions. Where they are not, previous ſyllogiſms are required; in which caſe reaſoning becomes a complicated act, taking in a variety of ſucceſſive ſteps. This frequently happens in tracing the more remote relation of our ideas; where, many middle terms being called in, the concluſion cannot be made out but in conſequence of a ſeries of ſyllogiſms following one another in train. But although in this concatenation of propoſitions, thoſe that form the premiſes of the laſt ſyllogiſm are often conſiderably removed from ſelf-evidence; yet if we trace the reaſoning backwards, we ſhall find them the concluſions of previous ſyllogiſms, whoſe premiſes approach nearer and nearer to intuition in proportion as we advance, and are found at laſt to terminate in it. And if, after having thus unravelled a demonſtration, we take it the contrary way; and obſerve how the mind, ſetting out with intuitive perceptions, couples them together to form a concluſion; how, by introducing this concluſion into another ſyllogiſm, it ſtill advances one ſtep farther; and ſo proceeds, making every new diſcovery ſubſervient to its future progreſs; we ſhall then perceive clearly, that reaſoning, in the higheſt ſenſe of that faculty, is no more than an orderly combination of thoſe ſimple acts which we have already ſo fully explained.

67 Requires intuitive certainty in every ſtep of the progreſſion.

IX. Thus we ſee, that reaſoning, beginning with firſt principles, riſes gradually from one judgement to another, and connects them in ſuch manner, that every ſtage of the progreſſion brings intuitive certainty along with it. And now at length we may clearly underſtand the definition given above of this diſtinguiſhing faculty of the human mind. Reaſon, we have ſaid, is the ability of deducing unknown truths from principles or propoſitions that are already known. This evidently appears by the foregoing account, where we ſee that no propoſition is admitted into a ſyllogiſm, to ſerve as one of the previous judgments on which the concluſion reſts, unleſs it is itſelf a known and eſtabliſhed truth, whoſe connection with ſelf-evident principles has been already traced.

CHAP. II. *Of the ſeveral kinds of Reaſoning; and firſt, of that by which we determine the Genera and Species of Things.*

68 Reaſoning twofold.

I. ALL the aims of human reaſon may in the general be reduced to theſe two: 1. To rank things under thoſe univerſal ideas to which they truly belong; and, 2. To aſcribe to them their ſeveral attributes and properties in conſequence of that diſtribution.

69 The firſt kind regards the genera and ſpecies of things.

II. One great aim of human reaſon is to determine the genera and ſpecies of things. We have ſeen in the Firſt Part of this treatiſe, how the mind proceeds in framing general ideas †. We have alſo ſeen in the Second Part, how by means of theſe general ideas we come by univerſal propoſitions. Now as in theſe univerſal propoſitions we affirm ſome property of a genus or ſpecies, it is plain that we cannot apply this property to particular objects till we have firſt determined whether they are comprehended under that general idea of which the property is affirmed. Thus there are certain properties belonging to all *even* numbers, which nevertheleſs cannot be applied to any particular number, until we have firſt diſcovered it to be of the ſpecies expreſſed by that natural name. Hence reaſoning begins with referring things to their ſeveral diviſions and claſſes in the ſcale of our ideas; and as theſe diviſions are all diſtinguiſhed by particular names, we hereby learn to apply the terms expreſſing general conceptions to ſuch particular objects as come under our immediate obſervation.

† See *Footnote*, p. 195.

70 The ſteps by which we arrive at concluſions of this ſort.

III. Now, in order to arrive at theſe concluſions, by which the ſeveral objects of perception are brought under general names, two things are manifeſtly neceſſary. Firſt, that we take a view of the idea itſelf denoted by that general name, and carefully attend to the

the diſtinguiſhing marks which ſerve to characterize it. Secondly, that we compare this idea with the object under conſideration, obſerving diligently wherein they agree or differ. If the idea is found to correſpond with the particular object, we then without heſitation apply the general name; but if no ſuch correſpondence intervenes, the concluſion muſt neceſſarily take a contrary turn. Let us, for inſtance, take the number *eight*, and conſider by what ſteps we are led to pronounce it an *even* number. Firſt then, we call to mind the idea ſignified by the expreſſion *an even number*, viz. that it is a number diviſible into two equal parts. We then compare this idea with the number *eight*, and, finding them manifeſtly to agree, ſee at once the neceſſity of admitting the concluſion. Theſe ſeveral judgments therefore transferred into language, and reduced to the form of a ſyllogiſm, appear thus:

"Every number that may be divided into two "equal parts is an *even* number:

"The number eight may be divided into two equal "parts;

"Therefore the number *eight* is an *even* number."

71 Thoſe ſteps always followed, tho' in familiar caſes we do not always attend to them.

IV. Here it may be obſerved, that where the general idea, to which particular objects are referred, is very familiar to the mind, and frequently in view; this reference, and the application of the general name, ſeem to be made without any apparatus of reaſoning. When we ſee a horſe in the fields, or a dog in the ſtreet, we readily apply the name of the ſpecies; habit, and a familiar acquaintance with the general idea, ſuggeſting it inſtantaneouſly to the mind. We are not however to imagine on this account that the underſtanding departs from the uſual rules of juſt thinking. A frequent repetition of acts begets a habit; and habits are attended with a certain promptneſs of execution, that prevents our obſerving the ſeveral ſteps and gradations by which any courſe of action is accompliſhed. But in other inſtances, where we judge not by precontracted habits, as when the general idea is very complex, or leſs familiar to the mind, we always proceed according to the form of reaſoning eſtabliſhed above. A goldſmith, for inſtance, who is in doubt as to any piece of metal, whether it be of the ſpecies called *gold*, firſt examines its properties, and then comparing them with the general idea ſignified by that name, if he finds a perfect correſpondence, no longer heſitates under what claſs of metals to rank it.

72 The great importance of this branch of reaſoning.

V. Nor let it be imagined that our reſearches here, becauſe in appearance bounded to the impoſing of general names upon particular objects, are therefore trivial and of little conſequence. Some of the moſt conſiderable debates among mankind, and ſuch too as nearly regard their lives, intereſt, and happineſs, turn wholly upon this article. Is it not the chief employment of our ſeveral courts of judicature to determine in particular inſtances, what is law, juſtice, and equity? Of what importance is it in many caſes to decide aright whether an action ſhall be termed *murder* or *manſlaughter?* We ſee then that no leſs than the lives and fortunes of men depend often upon theſe deciſions. The reaſon is plain. Actions, when once referred to a general idea, draw after them all that may be affirmed of that idea; inſomuch that the determining the ſpecies of actions is all one with determining what proportion of praiſe or diſpraiſe, commendation or blame, *&c.* ought to follow them. For as it is allowed that murder deſerves death; by bringing any particular action under the head of murder, we of courſe decide the puniſhment due to it.

73 And the exact obſervance of it practiſed by mathematicians.

VI. But the great importance of this branch of reaſoning, and the neceſſity of care and circumſpection in referring particular objects to general ideas, is ſtill farther evident from the practice of the mathematicians. Every one who has read Euclid knows, that he frequently requires us to draw lines through certain points, and according to ſuch and ſuch directions. The figures thence reſulting are often ſquares, parallelograms, or rectangles. Yet Euclid never ſuppoſes this from their bare appearance, but always demonſtrates it upon the ſtricteſt principles of geometry. Nor is the method he takes in any thing different from that deſcribed above. Thus, for inſtance, having defined a ſquare to be a figure bounded by four equal ſides joined together at right angles; when ſuch a figure ariſes in any conſtruction previous to the demonſtration of a propoſition, yet he never calls it by that name until he has ſhown that its ſides are equal, and all its angles right ones. Now this is apparently the ſame form of reaſoning we have before exhibited in proving *eight* to be an even number.

74 Fixed and invariable ideas, with a ſteady application of names, renders this part of knowledge both eaſy and certain.

VII. Having thus explained the rules by which we are to conduct ourſelves in ranking particular objects under general ideas, and ſhown their conformity to the practice and manner of the mathematicians; it remains only to obſerve, that the true way of rendering this part of knowledge both eaſy and certain, is, by habituating ourſelves to clear and determinate ideas, and keeping them ſteadily annexed to their reſpective names. For as all our aim is to apply general words aright, if theſe words ſtand for invariable ideas that are perfectly known to the mind, and can be readily diſtinguiſhed upon occaſion, there will be little danger of miſtake or error in our reaſonings. Let us ſuppoſe that, by examining any object, and carrying our attention ſucceſſively from one part to another, we have acquainted ourſelves with the ſeveral particulars obſervable in it. If among theſe we find ſuch as conſtitute ſome general idea, framed and ſettled beforehand by the underſtanding, and diſtinguiſhed by a particular name, the reſemblance thus known and perceived neceſſarily determines the ſpecies of the object, and thereby gives it a right to the name by which that ſpecies is called. Thus four equal ſides, joined together at right angles, make up the notion of a *ſquare*. As this is a fixed and invariable idea, without which the general name cannot be applied; we never call any particular figure a *ſquare* until it appears to have theſe ſeveral conditions; and contrarily, wherever a figure is found with theſe conditions, it neceſſarily takes the name of a *ſquare*. The ſame will be found to hold in all our other reaſonings of this kind, where nothing can create any difficulty but the want of ſettled ideas. If, for inſtance, we have not determined within ourſelves the preciſe notion denoted by the word *manſlaughter*, it will be impoſſible for us to decide whether any particular action ought to bear that name: becauſe, however nicely we examine the action itſelf, yet, being ſtrangers to the general idea with which it is to be compared, we are utterly unable

unable to judge of their agreement or disagreement. But if we take care to remove this obstacle, and distinctly trace the two ideas under consideration, all difficulties vanish, and the resolution becomes both easy and certain.

VIII. Thus we see of what importance it is towards the improvement and certainty of human knowledge, that we accustom ourselves to clear and determinate ideas, and a steady application of words.

Chap. III. *Of Reasoning, as it regards the Powers and Properties of Things, and the Relations of our general Ideas.*

75 The distinction of reasoning, as it regards the sciences and as it concerns common life.

I. We now come to the second great end which men have in view in their reasonings; namely, the discovering and ascribing to things their several attributes and properties. And here it will be necessary to distinguish between reasoning, as it regards the sciences, and as it concerns common life. In the sciences, our reason is employed chiefly about universal truths, it being by them alone that the bounds of human knowledge are enlarged. Hence the division of things into various classes, called otherwise *genera* and *species*. For these universal ideas being set up as the representatives of many particular things, whatever is affirmed of them may be also affirmed of all the individuals to which they belong. *Murder*, for instance, is a general idea, representing a certain species of human actions. Reason tells us that the punishment due to it is *death*. Hence every particular action, coming under the notion of *murder*, has the punishment of *death* allotted to it. Here then we apply the general truth to some obvious instance; and this is what properly constitutes the reasoning of common life. For men, in their ordinary transactions and intercourse one with another, have, for the most part, to do only with particular objects. Our friends and relations, their characters and behaviour, the constitution of the several bodies that surround us, and the uses to which they may be applied, are what chiefly engage our attention. In all these, we reason about particular things; and the whole result of our reasoning is, the applying the general truths of the sciences in the ordinary transactions of human life. When we see a viper, we avoid it. Wherever we have occasion for the forcible action of water to move a body that makes considerable resistance, we take care to convey it in such a manner that it shall fall upon the object with impetuosity. Now all this happens in consequence of our familiar and ready application of these two general truths. *The bite of a viper is mortal. Water, falling upon a body with impetuosity, acts very forcibly towards setting it in motion.* In like manner, if we set ourselves to consider any particular character, in order to determine the share of praise or dispraise that belongs to it, our great concern is to ascertain exactly the proportion of virtue and vice. The reason is obvious. A just determination, in all cases of this kind, depends entirely upon an application of these general maxims of morality: *Virtuous actions deserve praise; vicious actions deserve blame.*

II. Hence it appears that reasoning, as it regards common life, is no more than the ascribing the general properties of things to those several objects with which we are more immediately concerned, according as they are found to be of that particular division or class to which the properties belong. The steps then by which we proceed are manifestly these. First, we refer the object under consideration to some general idea or class of things. We then recollect the several attributes of that general idea. And, lastly, ascribe all those attributes to the present object. Thus, in considering the character of *Sempronius*, if we find it to be of the kind called *virtuous*, when we at the same time reflect that a virtuous character is deserving of esteem, it naturally and obviously follows that Sempronius is so too. These thoughts put into a *syllogism*, in order to exhibit the form of reasoning here required, run thus:

76 The steps by which we proceed in the reasoning of common life.

"Every virtuous man is worthy of esteem.
"*Sempronius* is a virtuous man:
"Therefore *Sempronius* is worthy of esteem."

77 The connection and dependence of the two grand branches of reasoning one upon another.

III. By this *syllogism* it appears, that before we affirm any thing of a particular object, that object must be referred to some general idea. Sempronius is pronounced worthy of esteem only in consequence of his being a virtuous man, or coming under that general notion. Hence we see the necessary connection of the various parts of reasoning, and the dependence they have one upon another. The determining the genera and species of things is, as we have said, one exercise of human reason; and here we find that this exercise is the first in order, and previous to the other, which consists in ascribing to them their powers, properties, and relations. But when we have taken this previous step, and brought particular objects under general names; as the properties we ascribe to them are no other than those of the general idea, it is plain that, in order to a successful progress in this part of knowledge, we must thoroughly acquaint ourselves with the several relations and attributes of these our general ideas. When this is done, the other part will be easy, and requires scarce any labour or thought, as being no more than an application of the general form of reasoning represented in the foregoing syllogism. Now, as we have already sufficiently shown how we are to proceed in determining the genera and species of things, which, as we have said, is the previous step to this second branch of human knowledge; all that is farther wanting towards a due explanation of it is, to offer some considerations as to the manner of investigating the general relations of our ideas. This is the highest exercise of the powers of the understanding, and that by means whereof we arrive at the discovery of universal truths; insomuch that our deductions in this way constitute that particular species of reasoning which we have before said regards principally the sciences.

78 Two things required to make a good reasoner.

IV. But that we may conduct our thoughts with some order and method, we shall begin with observing, that the relations of our general ideas are of two kinds: either such as immediately discover themselves, upon comparing the ideas one with another; or such as, being more remote and distant, require art and contrivance to bring them into view. The relations of the first kind furnish us with intuitive and self-evident truths: those of the second are traced by reasoning, and a due application of intermediate ideas. It is of this last kind that we are to speak here, having

dispatched what was necessary with regard to the other in the Second Part. As, therefore, in tracing the more distant relations of things, we must always have recourse to intervening ideas, and are more or less successful in our researches according to our acquaintance with these ideas, and ability of applying them; it is evident that, to make a good reasoner, two things are principally required. *First*, An extensive knowledge of those intermediate ideas, by means of which things may be compared one with another. *Secondly*, The skill and talent of applying them happily in all particular instances that come under consideration.

79 First, an extensive knowledge of intermediate ideas.

V. In order to our successful progress in reasoning, we must have an extensive knowledge of those intermediate ideas by means of which things may be compared one with another. For as it is not every idea that will answer the purpose of our inquiries, but such only as are peculiarly related to the objects about which we reason, so as, by a comparison with them, to furnish evident and known truths; nothing is more apparent than that the greater variety of conceptions we can call into view, the more likely we are to find some among them that will help us to the truths here required. And, indeed, it is found to hold in experience, that in proportion as we enlarge our views of things, and grow acquainted with a multitude of different objects, the reasoning faculty gathers strength: for, by extending our sphere of knowledge, the mind acquires a certain force and penetration, as being accustomed to examine the several appearances of its ideas, and observe what light they cast one upon another.

80 To excel in any one branch of learning, we must be in general acquainted with the whole circle of arts and sciences.

VI. This is the reason why, in order to excel remarkably in any one branch of learning, it is necessary to have at least a general acquaintance with the whole circle of arts and sciences. The truth of it is, all the various divisions of human knowledge are very nearly related among themselves, and, in innumerable instances, serve to illustrate and set off each other. And although it is not to be denied that, by an obstinate application to one branch of study, a man may make considerable progress, and acquire some degree of eminence in it; yet his views will be always narrow and contracted, and he will want that masterly discernment which not only enables us to pursue our discoveries with ease, but also, in laying them open to others, to spread a certain brightness around them. But when our reasoning regards a particular science, it is farther necessary that we more nearly acquaint ourselves with whatever relates to that science. A general knowledge is a good preparation, and enables us to proceed with ease and expedition in whatever branch of learning we apply to. But then, in the minute and intricate questions of any science, we are by no means qualified to reason with advantage until we have perfectly mastered the science to which they belong.

81 Secondly, the skill of applying intermediate ideas happily in particular instances.

VII. We come now to the second thing required, in order to a successful progress in reasoning; namely, the skill and talent of applying intermediate ideas happily in all particular instances that come under consideration. And here, rules and precepts are of little service. Use and experience are the best instructors. For, whatever logicians may boast of being able to form perfect reasoners by book and rule, we find by experience, that the study of their precepts does not always add any great degree of strength to the understanding. In short, it is the habit alone of reasoning that makes a reasoner. And therefore the true way to acquire this talent is, by being much conversant in those sciences where the art of reasoning is allowed to reign in the greatest perfection. Hence it was that the ancients, who so well understood the manner of forming the mind, always began with *mathematics*, as the foundation of their philosophical studies. Here the understanding is by degrees habituated to truth, contracts insensibly a certain fondness for it, and learns never to yield its assent to any proposition but where the evidence is sufficient to produce full conviction. For this reason *Plato* has called mathematical demonstations the *cathartics* or purgatives of the soul, as being the proper means to cleanse it from error, and restore that natural exercise of its faculties in which just thinking consists.

82 The study of mathematical demonstrations of great avail in this respect.

VIII. If therefore we would form our minds to a habit of reasoning closely and in train, we cannot take any more certain method than the exercising ourselves in mathematical demonstrations, so as to contract a kind of familiarity with them. Not that we look upon it as necessary that all men should be deep mathematicians; but that, having got the way of reasoning which that study necessarily brings the mind to, they may be able to transfer it to other parts of knowledge, as they shall have occasion.

83 As also of such authors on other subjects, as are distinguished for strength and justness of reasoning.

IX. But although the study of mathematics be of all others the most useful to form the mind and give it an early relish of truth, yet ought not other parts of philosophy to be neglected. For there also we meet with many opportunities of exercising the powers of the understanding; and the variety of subjects naturally leads us to observe all those different turns of thinking that are peculiarly adapted to the several ideas we examine, and the truth we search after. A mind thus trained acquires a certain mastery over its own thoughts, insomuch that it can range and model them at pleasure, and call such into view as best suit its present designs. Now in this the whole art of reasoning consists; from among a great variety of different ideas to single out those that are most proper for the business in hand, and to lay them together in such order, that from plain and easy beginnings, by gentle degrees, and a continued train of evident truths, we may be insensibly led on to such discoveries, as at our first setting out appeared beyond the reach of human understanding. For this purpose, besides the study of mathematics before recommended, we ought to apply ourselves diligently to the reading of such authors as have distinguished themselves for strength of reasoning, and a just and accurate manner of thinking. For it is observable, that a mind exercised and seasoned to truth, seldom rests satisfied in a bare contemplation of the arguments offered by others; but will be frequently assaying its own strength, and pursuing its discoveries upon the plan it is most accustomed to. Thus we insensibly contract a habit of tracing truth from one stage to another, and of investigating those general relations and properties which we afterwards ascribe to particular things, according as we find them compre-

hended

hended under the abſtract ideas to which the properties belong.

CHAP. IV. *Of the Forms of Syllogiſms.*

84 The figures of ſyllogiſms.

I. HITHERTO we have contented ourſelves with a general notion of ſyllogiſms, and of the parts of which they conſiſt. It is now time to enter a little more particularly into the ſubject, to examine their various forms, and lay open the rules of argumentation proper to each. In the ſyllogiſms mentioned in the foregoing chapters, we may obſerve, that the *middle term* is the ſubject of the *major* propoſition, and the predicate of the *minor*. This diſpoſition, though the moſt natural and obvious, is not however neceſſary; it frequently happening, that the middle term is the ſubject in both the premiſes, or the predicate in both; and ſometimes, directly contrary to its diſpoſition in the foregoing chapters, the predicate in the major, and the ſubject in the minor. Hence the diſtinction of ſyllogiſms into various kinds, called *figures* by logicians. For figure, according to their uſe of the word, is nothing elſe but the order and diſpoſition of the middle term in any ſyllogiſm. And as this diſpoſition is, we ſee, fourfold, ſo the figures of ſyllogiſms thence ariſing are four in number. When the middle term is the ſubject of the major propoſition, and the predicate of the minor, we have what is called the *firſt figure*: As,

"No work of God is bad:
"The natural paſſions and appetites of men are
"the work of God:
"Therefore none of them is bad."

If, on the other hand, it is the predicate of both the premiſes, the ſyllogiſm is ſaid to be the *ſecond figure*: As,

"Whatever is bad is not the work of God:
"All the natural paſſions and appetites of men
"are the work of God:
"Therefore the natural paſſions and appeties of
"men are not bad."

Again, in the *third figure*, the middle term is the ſubject of the two premiſes: As,

"All Africans are black:
"All Africans are men:
"Therefore ſome men are black."

And laſtly, by making it the predicate of the major, and ſubject of the minor, we obtain ſyllogiſms in the *fourth figure*: As,

"The only being who ought to be worſhipped is
"the Creator and Governor of the world:
"The Creator and Governor of the world is
"God:
"Therefore God is the only being who ought to
"be worſhipped."

85 The moods of ſyllogiſms.

II. But, beſides this fourfold diſtinction of ſyllogiſms, there is alſo a farther ſubdiviſion of them in every figure, ariſing from the *quantity* and *quality*, as they are called, of the propoſitions. By quantity we mean the conſideration of propoſitions, as univerſal or particular; by quality, as affirmative or negative.

Now as, in all the ſeveral diſpoſitions of the middle term, the propoſitions of which a ſyllogiſm conſiſts may be either univerſal or particular, affirmative or negative; the due determination of theſe, and ſo putting them together as the laws of argumentation require, conſtitute what logicians call the *moods* of ſyllogiſms. Of theſe moods there is a determinate number to every figure, including all the poſſible ways in which propoſitions differing in quantity or quality can be combined, according to any diſpoſition of the middle term, in order to arrive at a juſt concluſion.

The firſt figure has only four legitimate moods. The major propoſition in this figure muſt be univerſal, and the minor affirmative; and it has this property, that it yields concluſions of all kinds, affirmative and negative, univerſal and particular.

The ſecond figure has alſo four legitimate moods. Its major propoſition muſt be univerſal, and one of the premiſes muſt be negative. It yields concluſions both univerſal and particular, but all negative.

The third figure has ſix legitimate moods. Its minor muſt always be affirmative; and it yields concluſions both affirmative and negative, but all particular. ——Theſe are all the figures which were admitted by the inventor of ſyllogiſms; and of which, ſo far as we know, the number of legitimate moods has been aſcertained, and ſeverally demonſtrated. In *every figure* it will be found upon trial, that there are *ſixty-four* different moods of ſyllogiſm; and he who thinks it worth while to conſtruct ſo many in the *fourth* figure, always remembering that the *middle term* in each muſt be the *predicate* of the *major* and the *ſubject* of the *minor* propoſition, will eaſily diſcern what number of theſe moods are *legitimate*, and give true concluſions.

Beſides the rules that are proper to each figure, Ariſtotle has given ſome that are common to all, by which the legitimacy of ſyllogiſms may be tried. Theſe may be reduced to five: ——1. There muſt be only *three terms* in a ſyllogiſm: As each term occurs in two of the propoſitions, it muſt be preciſely the *ſame in both*; if it be *not*, the ſyllogiſm is ſaid to have *four terms*, which makes a *vicious* ſyllogiſm. 2. The *middle term* muſt be taken *univerſally* in *one* of the premiſes. 3. Both premiſes muſt *not be particular* propoſitions, nor both *negative*. 4. The *concluſion* muſt be *particular*, if *either* of the *premiſes* be *particular*; and *negative*, if *either* of the *premiſes* be *negative*. 5. No term can be taken *univerſally* in the *concluſion*, if it be *not* taken *univerſally* in the *premiſes*.

For underſtanding the *ſecond* and *fifth* of theſe rules, it is neceſſary to obſerve, that a term is ſaid to be taken *univerſally*, not only when it is the *ſubject* of a *univerſal* propoſition, but alſo when it is the *predicate* of a *negative* propoſition. On the other hand, a term is ſaid to be taken *particularly*, when it is either the *ſubject* of a *particular* or the *predicate* of an *affirmative* propoſition.

86 Foundation of the other diviſion of ſyllogiſms.

III. The diviſion of ſyllogiſms according to mood and figure reſpects thoſe eſpecially which are known by the name of plain ſimple ſyllogiſms; that is, which are bounded to three propoſitions, all ſimple, and where the extremes and middle term are connected, according to the rules laid down above. But as the mind is not tied down to any one preciſe form of reaſoning, but ſometimes makes uſe of more, ſometimes of fewer premiſes, and often takes in compound and conditional propoſitions, it may not be amiſs to take

notice of the different forms derived from this ſource, and explain the rules by which the mind conducts itſelf in the uſe of them.

87 Conditional ſyllogiſms.

IV. When in any ſyllogiſm the major is a conditional propoſition, the ſyllogiſm itſelf is termed *conditional*. Thus:

"If there is a God, he ought to be worſhipped:
"But there is a God:
"Therefore he ought to be worſhipped."

In this example, the major, or firſt propoſition, is, we ſee, conditional, and therefore the ſyllogiſm itſelf is alſo of the kind called by that name. And here we are to obſerve, that all conditional propoſitions are made of two diſtinct parts: one expreſſing the condition upon which the predicate agrees or diſagrees with the ſubject, as in this now before us, *if there is a God;* the other joining or disjoining the ſaid predicate and ſubject, as here, *he ought to be worſhipped.* The firſt of theſe parts, or that which implies the condition, is called the *antecedent;* the ſecond, where we join or diſjoin the predicate and ſubject, has the name of the *conſequent.*

88 Ground of illation in conditional ſyllogiſms.

V. In all propoſitions of this kind, ſuppoſing them to be exact in point of form, the relation between the antecedent and conſequent muſt ever be true and real; that is, the antecedent muſt always contain ſome certain and genuine condition, which neceſſarily implies the conſequent; for otherwiſe the propoſition itſelf will be falſe, and therefore ought not to be admitted into our reaſonings. Hence it follows, that when any conditional propoſition is aſſumed, if we admit the antecedent of that propoſition, we muſt at the ſame time neceſſarily admit the conſequent; but if we reject the conſequent, we are in like manner bound to reject the antecedent. For as the antecedent always expreſſes ſome condition which neceſſarily implies the truth of the conſequent; by admitting the antecedent, we allow of that condition, and therefore ought alſo to admit the conſequent. In like manner, if it appears that the conſequent ought to be rejected, the antecedent evidently muſt be ſo too; becauſe, as was juſt now demonſtrated, the admitting of the antecedent would neceſſarily imply the admiſſion alſo of the conſequent.

89 The two moods of conditional ſyllogiſms.

VI. There are two ways of arguing in *hypothetical* ſyllogiſms, which lead to a certain and unavoidable concluſion. For as the major is always a conditional propoſition, conſiſting of an antecedent and a conſequent; if the minor admits the antecedent, it is plain that the concluſion muſt admit the conſequent. This is called arguing from the admiſſion of the antecedent to the admiſſion of the conſequent, and conſtitutes that mood or ſpecies of hypothetical ſyllogiſms which is diſtinguiſhed in the ſchools by the name of the *modus ponens*, inaſmuch as by it the whole conditional propoſition, both antecedent and conſequent, is eſtabliſhed. Thus:

"If God is infinitely wiſe, and acts with perfect
"freedom, he does nothing but what is beſt:
"But God is infinitely wiſe, and acts with per-
"fect freedom:
"Therefore he does nothing but what is beſt."

Here we ſee the antecedent or firſt part of the conditional propoſition is eſtabliſhed in the minor, and the conſequent or ſecond part in the concluſion; whence the ſyllogiſm itſelf is an example of the *modus ponens*.

Bnt if now we on the contrary ſuppoſe that the minor rejects the conſequent, then it is apparent that the concluſion muſt alſo reject the antecedent. In this caſe we are ſaid to argue from the removal of the conſequent to the removal of the antecedent, and the particular mood or ſpecies of ſyllogiſms thence ariſing is called by logicians the *modus tollens*; becauſe in it both antecedent and conſequent are rejected or taken away, as appears by the following example.

"If God were not a Being of infinite goodneſs,
"neither would he conſult the happineſs of his
"creatures:
"But God does conſult the happineſs of his crea-
"tures:
"Therefore he is a being of infinite goodneſs.

90 They include all the legitimate ways of arguing.

VII. Theſe two ſpecies take in the whole claſs of conditional ſyllogiſms, and include all the poſſible ways of arguing that lead to a legitimate concluſion; becauſe we cannot here proceed by a contrary proceſs of reaſoning, that is, from the removal of the antecedent to the removal of the conſequent, or from the eſtabliſhing of the conſequent to the eſtabliſhing of the antecedent. For although the antecedent always expreſſes ſome real condition, which, once admitted, neceſſarily implies the conſequent, yet it does not follow that there is therefore no other condition; and if ſo, then, after removing the antecedent, the conſequent may ſtill hold, becauſe of ſome other determination that infers it. When we ſay, *If a ſtone is expoſed ſome time to the rays of the ſun, it will contract a certain degree of heat;* the propoſition is certainly true; and, admitting the antecedent, we muſt alſo admit the conſequent. But as there are other ways by which a ſtone may gather heat, it will not follow, from the ceaſing of the before-mentioned condition, that therefore the conſequent cannot take place. In other words, we cannot argue: *But the ſtone has not been expoſed to the rays of the ſun; therefore neither has it any degree of heat:* Inaſmuch as there are a great many other ways by which heat might have been communicated to it. And if we cannot argue from the removal of the antecedent to the removal of the conſequent, no more can we from the admiſſion of the conſequent to the admiſſion of the antecedent: becauſe, as the conſequent may flow from a great variety of different ſuppoſitions, the allowing of it does not determine the preciſe ſuppoſition, but only that ſome one of them muſt take place. Thus in the foregoing propoſition, *If a ſtone is expoſed ſome time to the rays of the ſun, it will contract a certain degree of heat;* admitting the conſequent, viz. *that it has contracted a certain degree of heat*, we are not therefore bound to admit the antecedent, *that it has been ſome time expoſed to the rays of the ſun;* becauſe there are many other cauſes whence that heat may have proceeded. Theſe two ways of arguing, therefore, hold not in conditional ſyllogiſms.

91 The manner of arguing in disjunctive ſyllogiſms.

VIII. As from the major's being a conditional propoſition, we obtain the ſpecies of conditional ſyllogiſms; ſo, where it is a disjunctive propoſition, the ſyllogiſm to which it belongs is alſo called *disjunctive*, as in the following example:

"The world is either ſelf-exiſtent, or the work
"of ſome finite, or of ſome infinite Being:
"But

" But it is not ſelf-exiſtent, nor the work of a fi-
" nite being:
" Therefore it is the work of an infinite Being."

Now, a disjunctive propoſition is that, where of ſeveral predicates, we affirm one neceſſarily to belong to the ſubject, to the excluſion of all the reſt, but leave that particular one undetermined. Hence it follows, that as ſoon as we determine the particular predicate, all the reſt are of courſe to be rejected; or if we reject all the predicates but one, that one neceſſarily takes place. When, therefore, in a disjunctive ſyllogiſm, the ſeveral predicates are enumerated in the major; if the minor eſtabliſhes any one of theſe predicates, the concluſion ought to remove all the reſt; or if, in the minor, all the predicates but one are removed, the concluſion muſt neceſſarily eſtabliſh that one. Thus, in the disjunctive ſyllogiſm given above, the major affirms one of the three predicates to belong to the earth, *viz. ſelf-exiſtence*, or that it is *the work of a finite*, or that it is *the work of an infinite Being*. Two of theſe predicates are removed in the minor, *viz. ſelf-exiſtence*, and *the work of a finite being*. Hence the concluſion neceſſarily aſcribes to it the third predicate, and affirms that it is *the work of an infinite Being*. If now we give the ſyllogiſm another turn, inſomuch that the minor may eſtabliſh one of the predicates, by affirming the earth to be *the production of an infinite Being:* then the concluſion muſt remove the other two, aſſerting it to be neither *ſelf-exiſtent*, nor *the work of a finite being*. Theſe are the forms of reaſoning in theſe ſpecies of ſyllogiſms, the juſtneſs of which appears at firſt ſight: and that there can be no other, is evident from the very nature of a disjunctive propoſition.

92 Imperfect or mutilated ſyllogiſms.

IX. In the ſeveral kinds of ſyllogiſms hitherto mentioned, we may obſerve, that the parts are complete; that is, the three propoſitions of which they conſiſt are repreſented in form. But it often happens, that ſome one of the premiſes is not only an evident truth, but alſo familiar and in the minds of all men; in which caſe it is uſually omitted, whereby we have an imperfect ſyllogiſm, that ſeems to be made up of only two propoſitions. Should we, for inſtance, argue in this manner:

" Every man is mortal:
" Therefore every king is mortal:"

the ſyllogiſm appears to be imperfect, as conſiſting but of two propoſitions. Yet it is really complete; only the minor [*every king is a man*] is omitted: and left to the reader to ſupply, as being a propoſition ſo familiar and evident that it cannot eſcape him.

93 Enthymemes.

X. Theſe ſeemingly imperfect ſyllogiſms are called *enthymemes;* and occur very frequently in reaſoning, eſpecially where it makes a part of common converſation. Nay, there is a particular elegance in them, becauſe, not diſplaying the argument in all its parts, they leave ſomewhat to the exerciſe and invention of the mind. By this means we are put upon exerting ourſelves, and ſeem to ſhare in the diſcovery of what is propoſed to us. Now this is the great ſecret of fine writing, ſo to frame and put together our thoughts, as to give full play to the reader's imagination, and draw him inſenſibly into our very views and courſe of reaſoning. This gives a pleaſure not unlike to that which the author himſelf feels in compoſing. It beſides ſhortens diſcourſe, and adds a certain force and livelineſs to our arguments, when the words in which they are conveyed favour the natural quickneſs of the mind in its operations, and a ſingle expreſſion is left to exhibit a whole train of thoughts.

94 Ground of reaſoning in immediate conſequences.

XI. But there is another ſpecies of reaſoning with two propoſitions, which ſeems to be complete in itſelf, and where we admit the concluſion without ſuppoſing any tacit or ſuppreſſed judgment in the mind, from which it follows ſyllogiſtically. This happens between propoſitions, where the connection is ſuch, that the admiſſion of the one neceſſarily and at the firſt ſight implies the admiſſion alſo of the other. For if it ſo falls out, that the propoſition on which the other depends is ſelf-evident, we content ourſelves with barely affirming it, and infer that other by a direct concluſion. Thus, by admitting an univerſal propoſition, we are forced alſo to admit of all the particular propoſitions comprehended under it, this being the very condition that conſtitutes a propoſition univerſal. If then that univerſal propoſition chances to be ſelf-evident, the particular ones follow of courſe, without any farther train of reaſoning. Whoever allows, for inſtance, *that things equal to one and the ſame thing are equal to one another*, muſt at the ſame time allow, *that two triangles, each equal to a ſquare whoſe ſide is three inches, are alſo equal between themſelves*. This argument therefore,

" Things equal to one and the ſame thing, are equal
" to one another:
" Therefore theſe two triangles, each equal to the
" ſquare of a line of three inches, are equal be-
" tween themſelves:"

is complete in its kind, and contains all that is neceſſary towards a juſt and legitimate concluſion. For the firſt or univerſal propoſition is ſelf-evident, and therefore requires no farther proof. And as the truth of the particular is inſeparably connected with that of the univerſal, it follows from it by an obvious and unavoidable conſequence.

95 All reducible to ſyllogiſms of ſome one form or other.

XII. Now, in all caſes of this kind, where propoſitions are deduced one from another, on account of a known and evident connection, we are ſaid to reaſon by immediate conſequence. Such a coherence of propoſitions manifeſt at firſt ſight, and forcing itſelf upon the mind, frequently occurs in reaſoning. Logicians have explained at ſome length the ſeveral ſuppoſitions upon which it takes place, and allow of all immediate conſequences that follow in conformity to them. It is however obſervable, that theſe arguments, though ſeemingly complete, becauſe the concluſion follows neceſſarily from the ſingle propoſition that goes before, may yet be conſidered as real enthymemes, whoſe major, which is a conditional propoſition, is wanting. The ſyllogiſm but juſt mentioned, when repreſented according to this view, will run as follows:

" If things equal to one and the ſame thing, are e-
" qual to one another; theſe two triangles, each
" equal to a ſquare whoſe ſide is three inches,
" are alſo equal between themſelves.
" But things equal to one and the ſame thing, are
" equal to one another:
" Therefore alſo theſe triangles, &c. are equal be-
" tween themſelves."

This obſervation will be found to hold in all imme-

diate conſequences whatſoever, inſomuch that they are in fact no more than enthymemes of hypothetical ſyllogiſms. But then it is particular to them, that the ground on which the concluſion reſts, namely its coherence with the minor, is of itſelf apparent, and ſeen immediately to flow from the rules and reaſons of logic.

96 A ſorites of plain ſimple ſyllogiſms.

XIII. The next ſpecies of reaſoning we ſhall take notice of here is what is commonly known by the name of a *ſorites*. This is a way of arguing, in which a great number of propoſitions are ſo linked together, that the predicate of one becomes continually the ſubject of the next following, until at laſt a concluſion is formed, by bringing together the ſubject of the firſt propoſition, and the predicate of the laſt. Of this kind is the following argument.

" God is omnipotent:
" An omnipotent being can do every thing poſſible:
" He that can do every thing poſſible, can do what-
" ever involves not a contradiction:
" Therefore God can do whatever involves not a
" contradiction."

This particular combination of propoſitions may be continued to any length we pleaſe, without in the leaſt weakening the ground upon which the concluſion reſts. The reaſon is, becauſe the ſorites itſelf may be reſolved into as many ſimple ſyllogiſms as there are middle terms in it; where this is found univerſally to hold, that when ſuch a reſolution is made, and the ſyllogiſms are placed in train, the concluſion of the laſt in the ſeries is alſo the concluſion of the ſorites. This kind of argument, therefore, as it ſerves to unite ſeveral ſyllogiſms into one, muſt ſtand upon the ſame foundation with the ſyllogiſms of which it conſiſts, and is indeed, properly ſpeaking, no other than a compendious way of reaſoning ſyllogiſtically.

97 A ſorites of hypothetical ſyllogiſms.

XIV. What is here ſaid of plain ſimple propoſitions may be as well applied to thoſe that are conditional; that is, any number of them may be ſo joined together in a ſeries, that the conſequent of one ſhall become continually the antecedent of the next following; in which caſe, by eſtabliſhing the antecedent of the firſt propoſition, we eſtabliſh the conſequent of the laſt, or by removing the laſt conſequent remove alſo the firſt antecedent. This way of reaſoning is exemplified in the following argument.

" If we love any perſon, all emotions of hatred to-
" wards him ceaſe:
" If all emotions of hatred towards a perſon ceaſe,
" we cannot rejoice in his misfortunes:
" If we rejoice not in his misfortunes, we certainly
" wiſh him no injury:
" Therefore, if we love a perſon, we wiſh him no
" injury."

It is evident that this ſorites, as well as the laſt, may be reſolved into a ſeries of diſtinct ſyllogiſms, with this only difference, that here the ſyllogiſms are all conditional.

98 The ground of argumentation in a dilemma.

XV. The laſt ſpecies of ſyllogiſm we ſhall take notice of in this chapter is that commonly diſtinguiſhed by the name of a *dilemma*. A dilemma is an argument by which we endeavour to prove the abſurdity or falſehood of ſome aſſertion. In order to this, we aſſume a conditional propoſition, the antecedent of which is the aſſertion to be diſproved, and the conſequent a disjunctive propoſition, enumerating all the poſſible ſuppoſitions upon which that aſſertion can take place. If then it appears, that all theſe ſeveral ſuppoſitions ought to be rejected, it is plain, that the antecedent or aſſertion itſelf muſt be ſo too. When therefore ſuch a propoſition as that before mentioned is made the major of any ſyllogiſm; if the minor rejects all the ſuppoſitions contained in the conſequent, it follows neceſſarily, that the concluſion ought to reject the antecedent, which, as we have ſaid, is the very aſſertion to be diſproved. This particular way of arguing is that which logicians call a *dilemma*; and from the account here given of it, it appears that we may in the general define it to be a hypothetical ſyllogiſm, where the conſequent of the major is a diſjunctive propoſition, which is wholly taken away or removed in the minor. Of this kind is the following:

" If God did not create the world perfect in its
" kind, it muſt either proceed from want of in-
" clination, or from want of power:
" But it could not proceed either from want of in-
" clination, or from want of power:
" Therefore, he created the world perfect in its
" kind." Or, which is the ſame thing: " It is
" abſurd to ſay that he did not create the world
" perfect in its kind."

99 An univerſal deſcription of it.

XVI. The nature then of a dilemma is univerſally this. The major is a conditional propoſition, whoſe conſequent contains all the ſeveral ſuppoſitions upon which the antecedent can take place. As therefore theſe ſuppoſitions are wholly removed in the minor, it is evident that the antecedent muſt be ſo too; inſomuch that we here always argue from the removal of the conſequent to the removal of the antecedent. That is, a dilemma is an argument in the *modus tollens* of hypothetical ſyllogiſms, as logicians love to ſpeak. Hence it is plain, that if the antecedent of the major is an affirmative propoſition, the concluſion of the dilemma will be negative; but if it is a negative propoſition, the concluſion will be affirmative.

CHAP. V. *Of Induction.*

100 Reaſon at firſt employed about particulars;

I. ALL reaſoning proceeds ultimately from firſt truths, either ſelf-evident or taken for granted; and the firſt truths of ſyllogiſtic reaſonings are *general* propoſitions. But except in the mathematics, and ſuch other ſciences as, being converſant about mere ideas, have no immediate relation to things without the mind, we cannot aſſume as truths propoſitions which are general. The mathematician indeed may be conſidered as taking his ideas from the beginning in their *general* form. Every *propoſition* compoſed of ſuch ideas is therefore general; and thoſe which are theoretic are reducible to two parts or *terms*, a *predicate* and a *ſubject*, with a *copula* generally affirmative. If the agreement or the relation between the two terms be not immediate and ſelf-evident, he has recourſe to an *axiom*, which is a propoſition ſtill *more general*, and which ſupplies him with a third or *middle term*. This he compares firſt with the *predicate*, and then with the *ſubject*, or *vice verſa*. Theſe two compariſons, when drawn out in form, make two pro-

poſitions, which are called the *premiſes*; and if they happen to be *immediate* and *ſelf-evident*, the *concluſion*, conſiſting of the terms of the queſtion propoſed, is ſaid to be demonſtrated. This method of reaſoning is conducted exactly in the ſyllogiſtic form explained in the preceding chapter.

II. But in ſciences which treat of things external to the mind, we cannot aſſume as *firſt principles* the moſt general propoſitions, and from them infer others leſs and leſs general till we deſcend to particulars. The reaſon is obvious. Every thing in the univerſe, whether of mind or body, preſents itſelf to our obſervation in its individual ſtate; ſo that *perception* and *judgment* employed in the inveſtigation of truth, whether *phyſical*, *metaphyſical*, *moral*, or *hiſtorical*, have in the firſt place to encounter with PARTICULARS. "With theſe reaſon begins, or ſhould begin, its operations. It obſerves, tries, canvaſſes, examines, and compares them together, and judges of them by ſome of thoſe native evidences and original lights which, as they are the firſt and indiſpenſable inlets of knowledge to the mind, have been called the *primary principles of truth*. See METAPHYSICS.

101 From which, by *induction*, it aſcends to generals or axioms.

III. "By ſuch acts of obſervation and judgment, diligently practiſed and frequently repeated, on many *individuals* of the ſame claſs or of a ſimilar nature, noting their agreements, marking their differences however minute, and rejecting all inſtances which, however ſimilar in appearance, are not in effect the ſame, REASON, with much labour and attention, extracts ſome *general laws* reſpecting the powers, properties, qualities, actions, paſſions, virtues, and relations of *real things*. This is no haſty, premature, *notional* abſtraction of the mind, by which images and ideas are formed that have no archetypes in nature: it is a rational, operative, experimental proceſs, inſtituted and executed upon the conſtitution of beings, which in part compoſe the univerſe. By this proceſs REASON advances from *particulars* to *generals*, from *leſs general* to *more general*, till by a ſeries of ſlow progreſſion, and by regular degrees, it arrive at the *moſt general* notions, called FORMS or FORMAL CAUSES(C). And by *affirming* or *denying* a genus of a ſpecies, or an accident of a ſubſtance or claſs of ſubſtances, through all the ſtages of the gradation, we form *concluſions*, which, if logically drawn, are AXIOMS(D) or general propoſitions ranged one above another, till they terminate in thoſe that are UNIVERSAL.

102 The proceſs of induction exemplified in phyſics.

IV. "Thus, for inſtance, *the evidence of the external ſenſes* is obviouſly the PRIMARY PRINCIPLE from which all phyſical knowledge is derived. But, whereas nature begins with *cauſes*, which, after a variety of changes, produce *effects*, the ſenſes open upon the *effects*, and from them, through the ſlow and painful road of experiment and obſervation, aſcend to *cauſes*. By *experiments* and *obſervations* ſkilfully choſen, artfully conducted, and judiciouſly applied, the philoſopher advances from one ſtage of inquiry to another in the rational inveſtigation of the *general cauſes* of phyſical truth. From different experiments and obſervations made on the ſame individual ſubject, and from the ſame experiments and obſervations made on different ſubjects of the ſame kind, by comparing and judging, he diſcovers ſome *qualities*, *cauſes*, or *phenomena*, which, after carefully diſtinguiſhing and rejecting all contradictory inſtances that occur, he finds common to *many*. Thus, from many collateral compariſons and judgments formed upon *particulars*, he aſcends to *generals*; and by a repetition of the ſame induſtrious proceſs and laborious inveſtigation, he advances from *general* to *more general*, till at laſt he is enabled to form a few of the *moſt general*, with their attributes and operations, into AXIOMS or *ſecondary principles*, which are the well-founded *laws* enacted and enforced by the God of nature.—This is that juſt and philoſophic method of reaſoning which ſound logic preſcribes in this as well as in other parts of learning; by which, through the ſlow but certain road of experiment and obſervation, the mind aſcends from appearances to qualities, from effects to cauſes, and from experiments upon many particular ſubjects forms *general propoſitions* concerning the powers and properties of phyſical body.

103 Axioms, ſo eſtabliſhed, applicable to all parts of learning.

V. "AXIOMS ſo inveſtigated and eſtabliſhed are applicable to all parts of learning, and are the indiſpenſable, and indeed the wonderful expedients, by which, in every branch of knowledge, reaſon puſhes on its inquiries in the particular purſuit of truth: and the method of reaſoning by which they are formed, is that of true and legitimate INDUCTION; which is therefore by Lord

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(C) Qui FORMAS novit, is, quæ adhuc non facta ſunt, qualia nec naturæ viciſſitudines, nec experimentales induſtriæ unquam in actum produxiſſent, nec cogitationem humanam ſubituræ fuiſſent, detegit et educit. *Baconi Nov. Org.*

(D) The word axiom αξιωμα literally ſignifies *dignity*: Hence it is uſed metaphorically to denote a *general truth* or maxim, and ſometimes any truth that is ſelf-evident, which is called a *dignity* on account of its importance in a proceſs of reaſoning. The axioms of Euclid are propoſitions extremely general; and ſo are the axioms of the Newtonian philoſophy. But theſe two kinds of axioms have very different origins. The former appear true upon a bare contemplation of our ideas; whereas the latter are the reſult of the moſt laborious induction. Lord Bacon therefore ſtrenuouſly contends that they ſhould never be taken upon conjecture, or even upon the authority of the learned; but that, as they are the general principles and grounds of all learning, they ſhould be canvaſſed and examined with the moſt ſcrupulous attention, "ut axiomatum corrigatur iniquitas, quæ plerumque in exemplis vulgatis fundamentum habent:" *De Augm. Sc.* lib. ii. cap. 2. "Atque illa ipſa putativa principia ad rationes reddendas compellare decrevimus, quouſque plane conſtant:" *Diſtrib. Operis.*—— Dr Tatham makes a diſtinction between axioms *intuitive* and axioms *ſelf-evident*. *Intuitive* axioms, according to him, paſs through the firſt inlets of knowledge, and flaſh direct conviction on the minds, as external objects do on the ſenſes, of all men. Other axioms, though not intuitive, may be properly ſaid to be *ſelf-evident*; becauſe, in their formation, reaſon judges by ſingle compariſons without the help of a third idea or middle term; ſo that they have their evidence in themſelves, and though inductively framed they cannot be ſyllogiſtically proved. If this diſtinction be juſt, and we think it is, only *particular* truths can be intuitive axioms.

Lord Bacon, the beſt and ſoundeſt of logicians, called the *key of interpretation*.

VI. "Inſtead of taking his axioms arbitrarily out of the great families of the categories (ſee CATEGORY), and erecting them by his own ſophiſtical invention into the principles upon which his diſputation was to be employed, had the analytical genius of Ariſtotle preſented us with the laws of the true INDUCTIVE LOGIC, by which AXIOMS are philoſophically formed, and had he with his uſual ſagacity given us an example of it in a ſingle branch of ſcience; he would have brought to the temple of truth an offering more valuable than he has done by the aggregate of all his logical and philoſophical productions.

104 Induction prior to definition,

VII. "In all ſciences, except the mathematics, it is only after the INDUCTIVE proceſs has been induſtriouſly purſued and ſucceſsfully performed, that DEFINITION may be logically and uſefully introduced, by beginning with the *genus*, paſſing through all the graduate and ſubordinate ſtages, and marking the *ſpecific difference* as it deſcends, till it arrive at the *individual*, which is the ſubject of the queſtion. And by adding an *affirmation* or *negation* of the attribute of the *genus* on the *ſpecies* or *individual*, or of a general *accident* on the particular *ſubſtance* ſo defined, making the definition a propoſition, the truth of the queſtion will be logically ſolved without any farther proceſs. So that inſtead of being the *firſt*, as employed by the logic in common uſe, *definition* may be the *laſt* act of reaſon in the ſearch of truth in general.

105 And to ſyllogiſm.

VIII. "Theſe AXIOMS or general propoſitions, thus *inductively* eſtabliſhed, become another ſpecies of PRINCIPLES, which may be properly called SECONDARY, and which lay the foundation of the ſyllogiſtic method of reaſoning. When theſe are formed, but not before, we may ſafely admit the maxim with which logicians ſet out in the exerciſe of their art, as the great hinge on which their reaſoning and diſputation turn: *From truths that are already known, to derive others which are not known.* Or, to ſtate it more comprehenſively, ſo as to apply to probable as well as to ſcientific reaſoning—*From truths which are better known, to derive others which are leſs known.* Philoſophically ſpeaking, ſyllogiſtic reaſoning is, under *general propoſitions* to reduce others which are *leſs general* or which are *particular*; for the *inferior* ones are known to be true, only as we trace their connection with the *ſuperior*. Logically ſpeaking, it is, To predicate a *genus* of a *ſpecies* or *individual* comprehended under it, or an *accident* of the *ſubſtance* in which it is inherent.

106 Induction and ſyllogiſm totally different.

IX. "Thus INDUCTION and SYLLOGISM are the two methods of *direct reaſoning* correſponding to the two kinds of principles, *primary* and *ſecondary*, on which they are founded, and by which they are reſpectively conducted. In both methods, indeed, reaſon proceeds by *judging* and *comparing*, but the proceſs is different throughout; and though it may have the ſanction of Ariſtotle, an *inductive ſyllogiſm* is a ſoleciſm.

107 Induction the foundation of ſyllogiſm.

X. "Till general truths are aſcertained by induction, the *third* or *middle terms* by which ſyllogiſms are made are no where ſafely to be found. So that another poſition of the Stagyrite, *that ſyllogiſm is naturally prior in order to induction*, is equally unfounded; for *induction* does not only naturally but neceſſarily precede *ſyllogiſm*; and, except in mathematics, is in every reſpect indiſpenſable to its exiſtence; ſince, till generals are eſtabliſhed, there can be neither *definition*, *propoſition*, nor *axiom*, and of courſe no ſyllogiſm. And as induction is the firſt, ſo is it the more *eſſential* and fundamental inſtrument of reaſoning: for as ſyllogiſm cannot produce its own *principles*, it muſt have them from induction; and if the general propoſitions or ſecondary principles be imperfectly or infirmly eſtabliſhed, and much more if they be taken at hazard, upon authority, or by arbitrary aſſumption like thoſe of Ariſtotle, all the ſyllogiſing in the world is a vain and uſeleſs logomachy, only inſtrumental to the multiplication of falſe learning, and to the invention and confirmation of error. The truth of ſyllogiſms depends ultimately on the truth of axioms, and the truth of axioms on the ſoundneſs of inductions (E)."—But though induction is prior in order, as well as ſuperior in utility, to ſyllogiſm, we have thought it expedient to treat of it laſt; both becauſe ſyllogiſm is an eaſier exerciſe of the reaſoning faculty than induction, and becauſe it is the method of mathematics, the firſt ſcience of reaſon in which the ſtudent is commonly initiated.

108 Why we have treated of ſyllogiſm firſt.

CHAP. VI. *Of Demonſtration.*

I. HAVING diſpatched what ſeemed neceſſary to be ſaid with regard to the two methods of direct reaſoning, *induction* and *ſyllogiſm*; we now proceed to conſider the laws of demonſtration. And here it muſt be acknowledged, that in ſtrict demonſtration, which removes from the mind all poſſibility of doubt or error, the inductive method of reaſoning can have no place. When the experiments and obſervations from which the general concluſion is drawn are numerous and extenſive, the reſult of this mode of reaſoning is moral certainty; and could the induction be made complete, it would be abſolute certainty, equally convincing with mathematical demonſtration. But however numerous and extenſive the obſervations and experiments may be upon which an inductive concluſion is eſtabliſhed, they muſt of neceſſity come ſhort of the number and extent of nature; which, in ſome caſes, by its immenſity, will defeat all poſſibility of their co-extenſion; and in others, by its diſtance, lies out of the reach of their immediate application. Though truth does not appear in all other departments of learning with that bold and reſiſtleſs conviction with which it preſides in the mathematical ſcience, it ſhines through them all, if not interrupted by prejudice or perverted by error, with a clear and uſeful, though inferior ſtrength. And as it is not neceſſary for the general ſafety or convenience of a traveller, that he ſhould always enjoy the heat and ſplendor of a mid-day ſun, whilſt he can with more eaſe purſue his journey under the weaker influence of a morning or an evening ray; ſo it is not requiſite, for the various concerns and purpoſes

(E) This chapter is almoſt wholly taken from *Tatham's Chart and Scale of Truth*; a work which, notwithſtanding the ruggedneſs of its ſtyle, has ſo much real merit as a ſyſtem of logic, that it cannot be too diligently ſtudied by the young inquirer who wiſhes to travel by the ſtraight road to the temple of Science.

poſes of life, that men ſhould be led by truth of the moſt redundant brightneſs. Such truth is to be had only in thoſe ſciences which are converſant about ideas and their various relations; where every thing being certainly what it appears to be, definitions and axioms ariſe from mere intuition. Here *ſyllogiſm* takes up the proceſs from the beginning; and by a ſublime intellectual motion advances from the ſimpleſt axioms to the moſt complicated ſpeculations, and exhibits truth ſpringing out of its firſt and pureſt elements, and ſpreading on all ſides into a ſyſtem of ſcience. As each ſtep in the progreſs is ſyllogiſtic, we ſhall endeavour to explain the uſe and application of ſyllogiſms in this ſpecies of reaſoning.

109 Of reaſoning by a concatenation of ſyllogiſms.

We have ſeen, that in all the different appearances they put on, we ſtill arrive at a juſt and legitimate concluſion; now it often happens, that the concluſion of one ſyllogiſm becomes a previous propoſition in another; by which means great numbers of them are ſometimes linked together in a ſeries, and truths are made to follow one another in train. And as in ſuch a concatenation of ſyllogiſms all the various ways of reaſoning that are truly concluſive may be with ſafety introduced; hence it is plain, that in deducing any truth from its firſt principles, eſpecially where it lies at a conſiderable diſtance from them, we are at liberty to combine all the ſeveral kinds of ſyllogiſms above explained, according as they are found beſt to ſuit the end and purpoſe of our inquiries. When a propoſition is thus, by means of ſyllogiſms, collected from others more evident and known, it is ſaid to be *proved;* ſo that we may in the general define the proof of a propoſition to be a ſyllogiſm, or ſeries of ſyllogiſms, collecting that propoſition from known and evident truths. But more particularly, if the ſyllogiſms of which the proofs conſiſt admit of no premiſes but definitions, ſelf-evident truths, and propoſitions already eſtabliſhed, then is the argument ſo conſtituted called a *demonſtration*; whereby it appears that demonſtrations are ultimately founded on definitions and ſelf-evident propoſitions.

110 All ſyllogiſms whatſoever reducible to the firſt figure.

II. All ſyllogiſms whatſoever, whether compound, multiform, or defective, are reducible to plain ſimple ſyllogiſms in ſome one of the four figures. But this is not all. Syllogiſms of the firſt figure, in particular, admit of all poſſible concluſions: that is, any propoſitions whatſoever, whether an univerſal affirmative or univerſal negative, a particular affirmative or particular negative, which fourfold diviſion embraces all their varieties; any one of theſe may be inferred by virtue of ſome ſyllogiſm in the firſt figure. By this means it happens that the ſyllogiſms of all the other figures are reducible alſo to ſyllogiſms of the firſt figure, and may be conſidered as ſtanding on the ſame foundation with them. We cannot here demonſtrate and explain the manner of this reduction, becauſe it would too much ſwell the bulk of this treatiſe. It is enough to take notice that the thing is univerſally known and allowed among logicians, to whoſe writings we refer ſuch as deſire farther ſatisfaction in this matter. This then being laid down, it is plain that any demonſtration whatſoever may be conſidered as compoſed of a ſeries of ſyllogiſms, all in the firſt figure. For, ſince all the ſyllogiſms that enter the demonſtration are reducible to ſyllogiſms of ſome one of the four figures; and ſince the ſyllogiſms of all the other figures are farther reducible to ſyllogiſms of the firſt figure, it is evident, that the whole demonſtration may be reſolved into a ſeries of theſe laſt ſyllogiſms. Let us now, if poſſible, diſcover the ground upon which the concluſion reſts in ſyllogiſms of the firſt figure; becauſe, by ſo doing, we ſhall come at an univerſal principle of certainty, whence the evidence of all demonſtrations in all their parts may be ultimately derived.

111 The ground of reaſoning in the firſt figure.

III. The rules then of the firſt figure are briefly theſe. The middle term is the ſubject of the major propoſition, and the predicate of the minor. The major is always an univerſal propoſition, and the minor always affirmative. Let us now ſee what effect theſe rules will have in reaſoning. The major is an univerſal propoſition, of which the middle term is the ſubject, and the predicate of the concluſion the predicate. Hence it appears, that in the major the predicate of the concluſion is always affirmed or denied univerſally of the middle term. Again the minor is an affirmative propoſition, whereof the ſubject of the concluſion is the ſubject, and the middle term the predicate. Here then the middle term is affirmed of the ſubject of the concluſion; that is, the ſubject of the concluſion is affirmed to be comprehended under, or to make a part of, the middle term. Thus then we ſee what is done in the premiſes of a ſyllogiſm of the firſt figure. The predicate of the concluſion is univerſally affirmed or denied of ſome idea. The ſubject of the concluſion is affirmed to be or to make a part of that idea. Hence it naturally and unavoidably follows, that the predicate of the concluſion ought to be affirmed or denied of the ſubject. To illuſtrate this by an example, we ſhall reſume one of the ſyllogiſms of the firſt chapter.

"Every creature poſſeſſed of reaſon and liberty is
"accountable for his actions:
"Man is a creature poſſeſſed of reaſon and liberty:
"Therefore man is accountable for his actions."

Here, in the firſt propoſition, the predicate of the concluſion, *accountableneſs*, is affirmed of all creatures that have reaſon and liberty. Again, in the ſecond propoſition, *man*, the ſubject of the concluſion, is affirmed to be or to make a part of this claſs of creatures. Hence the concluſion neceſſarily and unavoidably follows, *viz.* that man is accountable for his actions; becauſe, if reaſon and liberty be that which conſtitutes a creature accountable, and man has reaſon and liberty, it is plain he has that which conſtitutes him accountable. In like manner, where the major is a negative propoſition, or denies the predicate of the concluſion univerſally of the middle term, as the minor always aſſerts the ſubject of the concluſion to be or make a part of that middle term, it is no leſs evident that the predicate of the concluſion ought in this caſe to be denied of the ſubject. So that the ground of reaſoning, in all ſyllogiſms of the firſt figure, is manifeſtly this: "Whatever may be affirmed univerſally of any idea, may be affirmed of every or any number of particulars comprehended under that idea." And again: "Whatever may be denied univerſally of any idea, may be in like manner denied of every or any number of its individuals." Theſe two propoſitions are called by logicians the *dictum de omni*, and *dictum de nullo*; and are indeed the great

principles of ſyllogiſtic reaſoning, inaſmuch as all concluſions whatſoever either reſt immediately upon them, or upon propoſitions deduced from them. But what adds greatly to their value is, that they are really ſelf-evident truths, and ſuch as we cannot gainſay without running into an expreſs contradiction. To affirm, for inſtance, that *no man is perfect*, and yet argue that *ſome men are perfect*; or to ſay that *all men are mortal*, and yet that *ſome men are not mortal*, is to aſſert a thing to be and not to be at the ſame time.

112 Demonſtration an infallible guide to truth and certainty.

IV. And now we may affirm, that, in all ſyllogiſms of the firſt figure, if the premiſes are true, the concluſion muſt needs be true. If it be true that the predicate of the concluſion, whether affirmative or negative, agrees univerſally to ſome idea; and if it be alſo true that the ſubject of the concluſion is a part of or comprehended under that idea; then it neceſſarily follows, that the predicate of the concluſion agrees alſo to the ſubject. For to aſſert the contrary, would be to run counter to ſome one of the two principles before eſtabliſhed; that is, it would be to maintain an evident contradiction. And thus we are come at laſt to the point we have been all along endeavouring to eſtabliſh; namely, that every propoſition which can be demonſtrated is neceſſarily true. For as every demonſtration may be reſolved into a ſeries of ſyllogiſms all in the firſt figure; and as in any one of theſe ſyllogiſms, if the premiſes are true, the concluſion muſt needs be ſo too; it evidently follows, that if all the ſeveral premiſes are true, all the ſeveral concluſions are ſo, and conſequently the concluſion alſo of the laſt ſyllogiſm, which is always the propoſition to be demonſtrated. Now that all the premiſes of a demonſtration are true, will eaſily appear from the very nature and definition of that form of reaſoning. A demonſtration, as we have ſaid, is a ſeries of ſyllogiſms, all whoſe premiſes are either definitions, ſelf-evident truths, or propoſitions already eſtabliſhed. Definitions are identical propoſitions, wherein we connect the deſcription of an idea with the name by which we chooſe to have that idea called, and therefore as to their truth there can be no diſpute. Self-evident propoſitions appear true of themſelves, and leave no doubt or uncertainty in the mind. Propoſitions, before eſtabliſhed, are no other than concluſions gained by one or more ſteps from definitions and ſelf-evident principles, that is, from true premiſes, and therefore muſt needs be true. Whence all the previous propoſitions of a demonſtration being, we ſee, manifeſtly true; the laſt concluſion, or propoſition to be demonſtrated, muſt be ſo too. So that demonſtration not only leads to certain truth, but we have here alſo a clear view of the ground and foundation of that certainty. For as, in demonſtrating, we may be ſaid to do nothing more than combine a ſeries of ſyllogiſms together, all reſting on the ſame bottom; it is plain that one uniform ground of certainty runs through the whole, and that the concluſions are every where built upon ſome one of the two principles before eſtabliſhed, as the foundation of all our reaſoning. Theſe two principles are eaſily reduced into one, and may be expreſſed thus: "Whatever predicate, whether affirmative or negative, agrees univerſally to any idea; the ſame muſt needs agree to every or any number of individuals comprehended under that idea." And thus at length we have, according to our firſt deſign, reduced the certainty of demonſtration to one ſimple and univerſal principle; which carries its own evidence along with it, and which is indeed the ultimate foundation of all ſyllogiſtic reaſoning.

113 The rules of logic furniſh a ſufficient criterion for the diſtinguiſhing between truth and falſehood;

V. Demonſtration therefore ſerving as an infallible guide to truth, and ſtanding on ſo ſure and unalterable a baſis, we may now venture to aſſert, that the rules of logic furniſh a ſufficient criterion for the diſtinguiſhing between truth and falſehood. For ſince every propoſition that can be demonſtrated is neceſſarily true, he is able to diſtinguiſh truth from falſehood who can with certainty judge when a propoſition is truly demonſtrated. Now, a demonſtration is, as we have ſaid, nothing more than a concatenation of ſyllogiſms, all whoſe premiſes are definitions, ſelf-evident truths, or propoſitions previouſly eſtabliſhed. To judge therefore of the validity of a demonſtration, we muſt be able to diſtinguiſh whether the definitions that enter it are genuine, and truly deſcriptive of the ideas they are meant to exhibit: whether the propoſitions aſſumed without proofs as intuitive truths have really that ſelf-evidence to which they lay claim: whether the ſyllogiſms are drawn up in due form, and agreeable to the laws of argumentation: in fine, whether they are combined together in a juſt and orderly manner, ſo that no demonſtrable propoſitions ſerve any where as premiſes unleſs they are concluſions of previous ſyllogiſms. Now, it is the buſineſs of logic, in explaining the ſeveral operations of the mind, fully to inſtruct us in all theſe points. It teaches the nature and end of definitions, and lays down the rules by which they ought to be framed. It unfolds the ſeveral ſpecies of propoſitions, and diſtinguiſhes the ſelf-evident from the demonſtrable. It delineates alſo the different forms of ſyllogiſms, and explains the laws of argumentation proper to each. In fine, it deſcribes the manner of combining ſyllogiſms, ſo as that they may form a train of reaſoning, and lead to the ſucceſſive diſcovery of truth. The precepts of logic, therefore, as they enable us to judge with certainty when a propoſition is duly demonſtrated, furniſh a ſure criterion for the diſtinguiſhing between truth and falſehood.

114 And extending to all caſes where a certain knowledge of truth is attainable.

VI. Perhaps it may be objected, that demonſtration is a thing very rare and uncommon, as being the prerogative of but a few ſciences, and therefore the criterion here given can be of no great uſe. But wherever, by the bare contemplation of our ideas, truth is diſcoverable, there alſo demonſtration may be attained. Now that is an abundantly ſufficient criterion which enables us to judge with certainty in all caſes where the knowledge of truth comes within our reach; for with diſcoveries, that lie beyond the limits of the human mind, we have, properly, no buſineſs or concernment. When a propoſition is demonſtrated, we are certain of its truth. When, on the contrary, our ideas are ſuch as have no viſible connection or repugnance, and therefore furniſh not the proper means of tracing their agreement or diſagreement, there we are ſure that ſcientifical knowledge is not attainable. But where there is ſome foundation of reaſoning, which yet amounts not to the full evidence of demonſtration, there the precepts of logic, by teaching us to determine aright of the degree of proof,

proof, and of what is ſtill wanting to render it full and complete, enable us to make a due eſtimate of the meaſures of probability, and to proportion our aſſent to the grounds on which the propoſition ſtands. And this is all we can poſſibly arrive at, or even ſo much as hope for, in the exerciſe of faculties ſo imperfect and limited as ours.

115 The diſtinction of demonſtration into direct and indirect.

VII. Before we conclude this chapter, it may not be improper to take notice of the diſtinction of demonſtration into *direct* and *indirect*. A *direct demonſtration* is, when, beginning with definitions, ſelf-evident propoſitions, or known and allowed truths, we form a train of ſyllogiſms, and combine them in an orderly manner, continuing the ſeries through a variety of ſucceſſive ſteps, until at laſt we arrive at a ſyllogiſm whoſe concluſion is the propoſition to be demonſtrated. Proofs of this kind leave no doubt or uncertainty behind them; becauſe, all the ſeveral premiſes being true, the concluſions muſt be ſo too, and of courſe the very laſt concluſion or propoſition to be proved. The other ſpecies of demonſtration is the *indirect*, or, as it is ſometimes called, the *apogogical*. The manner of proceeding here is, by aſſuming a propoſition which directly contradicts that we mean to demonſtrate; and thence, by a continued train of reaſoning, in the way of a direct demonſtration, deducing ſome abſurdity or manifeſt untruth. For hereupon we conclude, that the propoſition aſſumed was falſe; and thence again, by an immediate conſequence, that the propoſition to be demonſtrated is true. Thus Euclid, in his third book, being to demonſtrate *that circles which touch one another inwardly have not the ſame centre*, aſſumes the direct contrary to this, viz. *that they have the ſame centre;* and thence, by an evident train of reaſoning, proves *that a part is equal to the whole*. The ſuppoſition therefore leading to this abſurdity he concludes to be falſe, viz. *that circles touching one another inwardly have the ſame centre;* and thence again immediately infers, *that they have not the ſame centre*.

116 Ground of reaſoning in indirect demonſtrations.

VIII. Now, becauſe this manner of demonſtration is accounted by ſome not altogether ſo clear and ſatisfactory; we ſhall therefore endeavour to ſhow, that it equally with the other leads to truth and certainty. Two propoſitions are ſaid to be *contradictory* one of another, when that which is aſſerted to be in the one is aſſerted not to be in the other. Thus the propoſitions, *Circles that touch one another inwardly have the ſame centre*, and *Circles that touch one another inwardly have not the ſame centre*, are *contradictories*, becauſe the ſecond aſſerts the direct contrary of what is aſſerted in the firſt. Now, in all contradictory propoſitions, this holds univerſally, That one of them is neceſſarily true, and the other neceſſarily falſe. For if it be true, that circles which touch one another inwardly have not the ſame centre; it is unavoidably falſe, that they have the ſame centre. On the other hand, if it be falſe that they have the ſame centre, it is neceſſarily true that they have not the ſame centre. Since therefore it is impoſſible for them to be both true or both falſe at the ſame time; it unavoidably follows, that one is neceſſarily true, and the other neceſſarily falſe. This then being allowed, which is indeed ſelf-evident; if any two contradictory propoſitions are aſſumed, and one of them can by a clear train of reaſoning be demonſtrated to be falſe, it neceſſarily follows that the other is true. For as the one is neceſſarily true, and the other neceſſarily falſe; when we come to diſcover which is the falſe propoſition, we thereby alſo know the other to be true.

117 Indirect demonſtrations a ſure guide to certainty.

IX. Now this is preciſely the manner of an indirect demonſtration, as is evident from the account given of it above. For there we aſſume a propoſition which directly contradicts that we mean to demonſtrate; and, having by a continued ſeries of proofs ſhown it to be falſe, thence infer that its contradictory, or the propoſition to be demonſtrated is true. As, therefore, this laſt concluſion is certain and unavoidable; let us next inquire after what manner we come to be ſatisfied of the falſehood of the aſſumed propoſition, that ſo no poſſible doubt may remain as to the force and validity of demonſtrations of this kind. The manner then is plainly this: Beginning with the aſſumed propoſition, we, by the help of definitions, ſelf-evident truths, or propoſitions already eſtabliſhed, continue a ſeries of reaſoning, in the way of a direct demonſtration, until at length we arrive at ſome abſurdity or known falſehood. Thus Euclid, in the example before-mentioned, from the ſuppoſition that circles touching one another inwardly have the ſame centre, deduces, *that a part is equal to the whole*. Since, therefore, by a due and orderly proceſs of reaſoning, we come at laſt to a falſe concluſion; it is manifeſt, that all the premiſes cannot be true: for, were all the premiſes true, the laſt concluſion muſt be ſo too, by what has been before demonſtrated. Now, as to all the other premiſes made uſe of in the courſe of reaſoning, they are manifeſt and known truths by ſuppoſition, as being either definitions, ſelf-evident propoſitions, or truths previouſly eſtabliſhed. The aſſumed propoſition is that only as to which any doubt or uncertainty remains. That alone, therefore, can be falſe; and indeed, from what has been already ſhown, muſt unavoidably be ſo. And thus we ſee, that in indirect demonſtrations, two contradictory propoſitions being laid down, one of which is demonſtrated to be falſe, the other, which is always the propoſition to be proved, muſt neceſſarily be true; ſo that here, as well as in the direct way of proof, we arrive at a clear and ſatisfactory knowledge of truth.

118 A particular caſe of indirect demonſtrations.

X. This is univerſally the method of reaſoning in all apogogical or indirect demonſtrations. But if any propoſition is aſſumed, from which, in a direct train of reaſoning, we can deduce its contradictory; the propoſition ſo aſſumed is falſe, and the contradictory one true. For if we ſuppoſe the aſſumed propoſition to be true, then, ſince all the other premiſes that enter the demonſtration are alſo true, we ſhall have a ſeries of reaſoning conſiſting wholly of true premiſes; whence the laſt concluſion or contradictory of the aſſumed propoſition muſt be true likewiſe: ſo that by this means we ſhould have two contradictory propoſitions both true at the ſame time, which is manifeſtly impoſſible. The aſſumed propoſition, therefore, whence this abſurdity flows, muſt neceſſarily be falſe; and conſequently its contradictory, which is here the propoſition deduced from it, muſt be true. If then any propoſition is propoſed to be demonſtrated, and we *aſſume* the *contradictory* of that propoſition, and thence directly infer the propoſition to be demonſtrated; by this very means we know that the propoſition ſo inferred,

ferred is true. For, ſince from an aſſumed propoſition we have deduced its contradictory, we are thereby certain that the aſſumed propoſition is falſe; and if ſo, then its contradictory, or that deduced from it, which in this caſe is the ſame with the propoſition to be demonſtrated, muſt be true.

119 A due knowledge of the principles of logic indiſpenſably neceſſary to make us proper judges of demonſtration.

XI. We have a curious inſtance of this in the twelfth propoſition of the ninth book of the Elements. Euclid there propoſes to demonſtrate, *that in any ſeries of numbers, riſing from unity in geometrical progreſſion, all the prime numbers that meaſure the laſt term in the ſeries will alſo meaſure the next after unity*. In order to this, he aſſumes the contradictory of the propoſition to be demonſtrated; namely, *that ſome prime number meaſuring the laſt term in the ſeries does not meaſure the next after unity;* and thence, by a continued train of reaſoning, proves that it actually does meaſure it. Hereupon he concludes the aſſumed propoſition to be falſe; and that which is deduced from it, or its contradictory, which is the very propoſition he propoſed to demonſtrate, to be true. Now that this is a juſt and concluſive way of reaſoning, is abundantly manifeſt from what we have ſo clearly eſtabliſhed above. Whence it appears, how neceſſary ſome knowledge of the rules of logic is, to enable us to judge of the force, juſtneſs, and validity, of demonſtrations. For, though it is readily allowed, that by the mere ſtrength of our natural faculties we can at once diſcern, that of two contradictory propoſitions, the one is neceſſarily true, and the other neceſſarily falſe; yet when they are ſo linked together in a demonſtration, as that the one ſerves as a previous propoſition whence the other is deduced, it does not ſo immediately appear, without ſome knowledge of the principles of logic, why that alone, which is collected by reaſoning, ought to be embraced as true, and the other, whence it is collected, to be rejected as falſe.

120 And of itſelf ſufficient to guard us againſt error and falſe reaſoning.

XII. Having thus ſufficiently evinced the certainty of demonſtration in all its branches, and ſhown the rules by which we ought to proceed, in order to arrive at a juſt concluſion, according to the various ways of arguing made uſe of; it is needleſs to enter upon a particular conſideration of thoſe ſeveral ſpecies of falſe reaſoning which logicians diſtinguiſh by the name of *ſophiſms*. He that thoroughly underſtands the form and ſtructure of a good argument, will of himſelf readily diſcern every deviation from it. And although *ſophiſms* have been divided into many claſſes, which are all called by ſounding names, that therefore carry in them much appearance of learning; yet are the errors themſelves ſo very palpable and obvious, that it would be loſt labour to write for a man capable of being miſled by them. Here, therefore, we chooſe to conclude this part of logic; and ſhall in the next give ſome account of *Method*: which, though inſeparable from reaſoning, is nevertheleſs always conſidered by logicians as a diſtinct operation of the mind; becauſe its influence is not confined to the mere exerciſe of the reaſoning faculty, but extends in ſome degree to all the tranſactions of the underſtanding.

Part IV. Of METHOD.

121 The underſtanding ſometimes employed in putting together known truths.

WE have now done with the three firſt operations of the mind, whoſe office it is to ſearch after truth, and enlarge the bounds of human knowledge. There is yet a fourth, which regards the diſpoſal and arrangement of our thoughts, when we endeavour ſo to put them together as that their mutual connection and dependence may be clearly ſeen. This is what logicians call *Method*, and place always the laſt in order in explaining the powers of the underſtanding; becauſe it neceſſarily ſuppoſes a previous exerciſe of our other faculties, and ſome progreſs made in knowledge before we can exert it in any extenſive degree.

122 Sometimes in the ſearch and diſcovery of ſuch as are unknown.

II. In this view, it is plain that we muſt be beforehand well acquainted with the truths we are to combine together; otherwiſe, how could we diſcern their ſeveral connections and relations, or ſo diſpoſe of them as their mutual dependence may require? But it often happens, that the underſtanding is employed, not in the arrangement and compoſition of known truths, but in the ſearch and diſcovery of ſuch as are unknown. And here the manner of proceeding is very different. We aſſemble at once our whole ſtock of knowledge relating to any ſubject, and, after a general ſurvey of things, begin with examining them ſeparately and by parts. Hence it comes to paſs, that whereas, at our firſt ſetting out, we were acquainted only with ſome of the grand ſtrokes and outlines of truth; by thus purſuing her through her ſeveral windings and receſſes, we gradually diſcover thoſe more inward and finer touches whence ſhe derives all her ſtrength, ſymmetry, and beauty. And here it is, that when, by a narrow ſcrutiny into things, we have unravelled any part of knowledge, and traced it to its firſt and original principles, inſomuch that the whole frame and contexture of it lies open to the view of the mind; here it is, that, taking it the contrary way, and beginning with theſe principles, we can ſo adjuſt and put together the parts as the order and method of ſcience requires.

123 Illuſtrated by the ſimilitude of a watch.

III. But as theſe things are beſt underſtood when illuſtrated by examples; let us ſuppoſe any machine, for inſtance a watch, preſented to us, whoſe ſtructure and compoſition we are as yet unacquainted with, but want, if poſſible, to diſcover. The manner of proceeding, in this caſe, is, by taking the whole to pieces, and examining the parts ſeparately, one after another. When, by ſuch a ſcrutiny, we have thoroughly informed ourſelves of the frame and contexture of each, we then compare them together, in order to judge of their mutual action and influence. By this means we gradually trace out the inward make and compoſition of the whole, and come at length to diſcern how parts of ſuch a form, and ſo put together as we found in unravelling and taking them aſunder, conſtitute that particular machine called a *watch*, and contribute to all the ſeveral motions and phenomena obſervable in it. This diſcovery being made, we can take things the contrary way, and, beginning with the parts, ſo diſpoſe and connect them as their ſeveral uſes and ſtructures require, until at length we arrive at the whole itſelf, from the unravelling of which thoſe parts reſulted.

IV. And

124 Ground of the analytic and synthetic methods.

IV. And as it is in tracing and examining the works of art; ſo is it, in a great meaſure, in unfolding any part of human knowledge: for the relations and mutual habitudes of things do not always immediately appear upon comparing them one with another. Hence we have recourſe to intermediate ideas; and, by means of them, are furniſhed with thoſe previous propoſitions that lead to the concluſion we are in queſt of. And if it ſo happen that the previous propoſitions themſelves are not ſufficiently evident, we endeavour, by new middle terms, to aſcertain their truth; ſtill tracing things backward, in a continual ſeries, until at length we arrive at ſome ſyllogiſm where the premiſes are firſt and ſelf-evident principles. This done, we become perfectly ſatisfied as to the truth of all the concluſions we have paſſed through, inaſmuch as they are now ſeen to ſtand upon the firm and immoveable foundation of our intuitive perceptions. And as we arrived at this certainty by tracing things backward to the original principles whence they flow; ſo may we at any time renew it by a direct contrary proceſs, if, beginning with theſe principles, we carry the train of our thoughts forward until they lead us, by a connected chain of proofs, to the very laſt concluſion of the ſeries.

125 Diviſion of method into analytic and ſynthetic.

V. Hence it appears, that, in diſpoſing and putting together our thoughts, either for our own uſe, that the diſcoveries we have made may at all times lie open to the review of the mind, or where we mean to communicate and unfold the diſcoveries to others, there are two ways of proceeding equally within our choice: for we may ſo propoſe the truths relating to any part of knowledge, as they preſented themſelves to the mind in the manner of inveſtigation; carrying on the ſeries of proofs, in a reverſe order, until they at laſt terminate in firſt principles: or, beginning with theſe principles, we may take the contrary way, and from them deduce, by a direct train of reaſoning, all the ſeveral propoſitions we want to eſtabliſh. This diverſity in the manner of arranging our thoughts gives riſe to the twofold diviſion of method eſtabliſhed among logicians: for method, according to their uſe of the word, is nothing elſe but the order and diſpoſition of our thoughts relating to any ſubject. When truths are ſo propoſed and put together as they were or might have been diſcovered, this is called the *analytic method*, or the *method of reſolution*; inaſmuch as it traces things backward to their ſource, and reſolves knowledge into its firſt and original principles. When, on the other hand, they are deduced from theſe principles, and connected according to their mutual dependence, inſomuch that the truths firſt in order tend always to the demonſtration of thoſe that follow; this conſtitutes what we call the *ſynthetic method*, or *method of compoſition*. For here we proceed by gathering together the ſeveral ſcattered parts of knowledge, and combining them into one whole or ſyſtem, in ſuch manner that the underſtanding is enabled diſtinctly to follow truth through all her different ſtages and gradations.

126 Called otherwiſe the method of invention, and the method of ſcience.

VI. There is this farther to be taken notice of, in relation to theſe two ſpecies of method; that the firſt has alſo obtained the name of the *method of invention*, becauſe it obſerves the order in which our thoughts ſucceed one another in the invention or diſcovery of truth. The other, again, is often denominated the *method of doctrine* or *inſtruction*; inaſmuch as, in laying our thoughts before others, we generally chooſe to proceed in the ſynthetic manner, deducing them from their firſt principles. For we are to obſerve, that although there is great pleaſure in purſuing truth in the method of inveſtigation, becauſe it places us in the condition of the inventor, and ſhows the particular train and proceſs of thinking by which he arrived at his diſcoveries; yet it is not ſo well accommodated to the purpoſes of evidence and conviction. For, at our firſt ſetting out, we are commonly unable to divine where the analyſis will lead us; inſomuch that our reſearches are for ſome time little better than a mere groping in the dark. And even after light begins to break in upon us, we are ſtill obliged to many reviews, and a frequent compariſon of the ſeveral ſteps of the inveſtigation among themſelves. Nay, when we have unravelled the whole, and reached the very foundation on which our diſcoveries ſtand, all our certainty, in regard to their truth, will be found in a great meaſure to ariſe from that connection we are now able to diſcern between them and firſt principles, taken in the order of compoſition. But in the ſynthetic manner of diſpoſing our thoughts, the caſe is quite different: for as we here begin with the intuitive truths, and advance by regular deductions from them, every ſtep of the procedure brings evidence and conviction along with it; ſo that, in our progreſs from one part of knowledge to another, we have always a clear perception of the ground on which our aſſent reſts. In communicating therefore our diſcoveries to others, this method is apparently to be choſen, as it wonderfully improves and enlightens the underſtanding, and leads to an immediate perception of truth.

VII. The logic which for ſo many ages kept poſſeſſion of the ſchools, and was deemed the moſt important of the ſciences, has long been condemned as a mere art of wrangling, of very little uſe in the purſuit of truth. Attempts have been made to reſtore it to credit, but without ſucceſs; and of late years little or no attention whatever has been paid to *the art of reaſoning* in the courſe of what is called a liberal education. As both extremes may be faulty, it ſhould ſeem that we cannot conclude this ſhort treatiſe more properly than with the following

Reflections on the Utility of Logic.

If Ariſtotle was not the inventor of logic, he was certainly the prince of logicians. The whole theory of ſyllogiſms he claims as his own, and as the fruit of much time and labour; and it is univerſally known, that the later writers on the art have borrowed their materials almoſt entirely from his Organon and Porphyry's Introduction. But after men had laboured near 2000 years in ſearch of truth by the help of ſyllogiſms, Lord Bacon propoſed the method of induction, as a more effectual engine for that purpoſe; and ſince his days the art of logic has gradually fallen into diſrepute.

To this conſequence many cauſes contributed. The art of ſyllogiſm is admirably calculated for wrangling; and by the ſchoolmen it was employed with too much ſucceſs, to keep in countenance the abſurdities of the Romiſh church. Under their management it produced numberleſs diſputes, and numberleſs ſects, who

fought againſt each other with much animoſity without gaining or loſing ground; but it did nothing conſiderable for the benefit of human life, whilſt the method of induction has improved arts and increaſed knowledge. It is no wonder, therefore, that the exceſſive admiration of Ariſtotle, which continued for ſo many ages, ſhould end in an undue contempt; and that the high eſteem of logic, as the grand engine of ſcience, ſhould at laſt make way for too unfavourable an opinion, which ſeems now prevalent, of its being unworthy of a place in a liberal education. Men rarely leave one extreme without running into the contrary: Thoſe who think according to the faſhion, will be as prone to go into the preſent extreme as their grandfathers were to go into the former; and even they who in *general* think for themſelves, when they are offended at the abuſe of any thing, are too apt to entertain prejudices againſt the *thing itſelf*. "In practice (ſays the learned WARBURTON †), logic is more a *trick* than a *ſcience*, formed rather to amuſe than to inſtruct. And in ſome ſort we may apply to the art of ſyllogiſm what a man of wit ſays of rhetoric, that it only tells us how to *name* thoſe tools which nature had before put into our hands. In the ſervice of chicane, indeed, it is a meer juggler's knot, now faſt, now looſe; and the ſchools where this legerdemain was exerciſed in great perfection are full of the ſtories of its wonders." The authority of *Warburton* is great; but it may be counterbalanced by another which, on ſubjects of this nature, is confeſſedly greater.

† *Introduction to Julian, &c.*

"Laying aſide prejudice, whether faſhionable or unfaſhionable, let us conſider (ſays Dr REID ‡) whether logic is or may be made ſubſervient to any good purpoſe. Its profeſſed end is, to teach men to think, to judge, and to reaſon, with preciſion and accuracy. No man will ſay that this is a matter of little importance: the only thing therefore that can admit of doubt is, whether it can be taught?

‡ *Appendix to Lord Kames's Sketch on the Principle and Progreſs of Reaſon.*

"To reſolve this doubt, it may be obſerved, that our rational faculty is the gift of God, given to men in very different meaſures: Some have a large portion, ſome a leſs; and where there is a remarkable defect of the natural power, it cannot be ſupplied by any culture. But this natural power, even where it is the ſtrongeſt, may lie dead for want of the means of improvement. Many a ſavage may have been born with as good faculties as a *Newton*, a *Bacon*, or an *Ariſtotle*; but their talents were buried by having never been put to uſe, whilſt thoſe of the philoſophers were cultivated to the beſt advantage. It may likewiſe be obſerved, that the chief mean of improving our rational power, is the vigorous exerciſe of it in various ways and on different ſubjects, by which the habit is acquired of exerciſing it properly. Without ſuch exerciſe, and good ſenſe over and above, a man who has ſtudied logic all his life may be only a petulant wrangler, without true judgment or ſkill of reaſoning in any ſcience."

This muſt have been Locke's meaning, when in his Thoughts on Education he ſays, "If you would have your ſon to reaſon well, let him read Chillingworth." The ſtate of things is much altered ſince Locke wrote: Logic has been much improved chiefly by his writings; and yet much leſs ſtreſs is laid upon it, and leſs time conſumed in its ſtudy. His counſel, therefore, was judicious and ſeaſonable; to wit, That the improvement of our reaſoning power is to be expected much more from an intimate acquaintance with the authors who reaſon beſt, than from ſtudying voluminous ſyſtems of ſchool logic. But if he had meant, that the ſtudy of logic was of no uſe, nor deſerved any attention, he ſurely would not have taken the pains to make ſo conſiderable an addition to it, by his *Eſſay on the Human Underſtanding*, and by his *Thoughts on the Conduct of the Underſtanding*; nor would he have remitted his pupil to *Chillingworth*, the acuteſt logician as well as the beſt reaſoner of his age."

There is no ſtudy better fitted to exerciſe and ſtrengthen the reaſoning powers than that of the mathematical ſciences; becauſe there is no other branch of ſcience which gives ſuch ſcope to long and accurate trains of reaſoning, or in which there is ſo little room for authority or prejudice of any kind to give a falſe bias to the judgment. When a youth of moderate parts begins to ſtudy Euclid, every thing is new to him: His apprehenſion is unſteady; his judgment is feeble; and reſts partly upon the evidence of the thing, and partly upon the authority of his teacher. But every time he goes over the definitions, the axioms, the elementary propoſitions, more light breaks in upon him; and as he advances, the road of demonſtration becomes ſmooth and eaſy: he can walk in it firmly, and take wider ſteps, till at laſt he acquires the habit not only of underſtanding a demonſtration, but of diſcovering and demonſtrating mathematical truths.

It muſt indeed be confeſſed, that a man without the rules of logic may acquire a habit of reaſoning juſtly in *mathematics*, and perhaps in any other ſcience. Good ſenſe, good examples, and aſſiduous exerciſe, may bring a man to reaſon juſtly and acutely in his own profeſſion without rules. But whoever thinks, that from this conceſſion he may infer the inutility of logic, betrays by this inference a great want of that art; for he might as well infer, becauſe a man *may* go from Edinburgh to London by the way of Paris, that therefore *any other* road is uſeleſs.

There is perhaps no art which may not be acquired, in a very conſiderable degree, by example and practice, without reducing it to rules. But practice joined with rules may carry a man forward in his art farther and more quickly than practice without rules.—Every ingenious artiſt knows the utility of having his art reduced to rules, and thereby made a ſcience. By rules he is enlightened in his practice, and works with more aſſurance. They enable him ſometimes to correct his own errors, and often to detect the errors of others; and he finds them of great uſe to confirm his judgment, to juſtify what is right, and to condemn what is wrong. Now mathematics are the nobleſt *praxis* of *logic*. Through them we may perceive how the ſtated forms of ſyllogiſm are exemplified in one ſubject, namely the predicament of quantity; and by marking the force of theſe forms, as they are there applied, we may be enabled to apply them of ourſelves elſewhere. Whoever, therefore, will ſtudy mathematics with this view, will become not only by mathematics a more expert *logician*, and by logic a more rational *mathematician*, but a wiſer philoſopher, and an acuter reaſoner, in all the poſſible ſubjects either of ſcience or deliberation. But when mathematics, inſtead of being applied to this ex-

cellent purpoſe, are uſed not to exemplify logic, but to ſupply its place; no wonder if logic fall into contempt, and if mathematics, inſtead of furthering ſcience, become in fact an obſtacle. For when men, knowing nothing of that reaſoning which is *univerſal*, come to attach themſelves for years to a *ſingle ſpecies*, a ſpecies wholly involved in *lines* and *numbers*, the mind becomes incapacitated for reaſoning at large, and eſpecially in the ſearch of *moral truth*. The object of mathematics is *demonſtration*; and whatever in that ſcience is not demonſtration, is nothing, or at leaſt below the ſublime inquirer's regard. *Probability*, through its almoſt infinite degrees, from ſimple ignorance up to abſolute certainty, is the *terra incognita* of the mathematician. And yet here it is that the great *buſineſs* of the human mind is carried on in the ſearch and diſcovery of all the important truths which concern us as reaſonable beings. And here too it is that all its *vigour* is exerted: for to proportion the aſſent to the probability accompanying every varying degree of moral evidence, requires the moſt enlarged and ſovereign exerciſe of reaſon.

In reaſonings of this kind, will any man pretend that it is of no uſe to be well acquainted with the various powers of the mind by which we reaſon? Is it of no uſe to reſolve the various kinds of reaſoning into their ſimple elements; and to diſcover, as far as we are able, the rules by which theſe elements are combined in judging and in reaſoning? Is it of no uſe to mark the various fallacies in reaſoning, by which even the moſt ingenious men have been led into error? It muſt ſurely betray great want of underſtanding, to think theſe things uſeleſs or unimportant. Now theſe are the things which logicians have attempted; and which they have executed—not indeed ſo completely as to leave no room for improvement, but in ſuch a manner as to give very conſiderable aid to our reaſoning powers. That the principles they have laid down with regard to definition and diviſion, with regard to the converſion and oppoſition of propoſitions, and the general rules of reaſoning, are not without uſe, is ſufficiently apparent from the blunders committed daily by thoſe who diſdain any acquaintance with them.

Although the art of categorical ſyllogiſm is confeſſedly little fitted for the diſcovery or unknown truth, it may yet be employed to excellent purpoſes, as it is perhaps the moſt compendious method of detecting a fallacy. A man in queſt of unknown truths muſt generally proceed by the way of induction, from effects to cauſes; but he, who as a teacher is to inculcate any ſyſtem upon others, begins with one or more ſelf-evident truths, and proceeds in the way of demonſtration, to the concluſion which he wiſhes to eſtabliſh. Now every demonſtration, as has been already obſerved, may be reſolved into a ſeries of ſyllogiſms, of which the concluſion of the preceding always enters into the premiſes of that which follows: and if the firſt principles be clear and evident, and every ſyllogiſm in ſome legitimate mode and figure, the concluſion of the whole muſt infallibly be admitted. But when the demonſtration is thus broken into parts; if we find that the concluſion of one ſyllogiſm will not, without altering the meaning of the terms, enter legitimately into the premiſes of that which ſhould immediately follow; or, ſuppoſing it to make one of the premiſes of a *new* ſyllogiſm, if we find that the concluſion, reſulting from the whole ſeries *thus* obtained, is different from that of the demonſtration; we may, in either of theſe caſes, reſt aſſured that the author's reaſoning is fallacious, and leads to error; and that if it carried an appearance of conviction before it was thus reſolved into its elementary parts, it muſt have been owing to the inability of the mind to comprehend at *once* a long train of arguments. Whoever wiſhes to ſee the ſyllogiſtic art employed for this purpoſe, and to be convinced of the truth of what we have ſaid reſpecting its utility, may conſult the excellent writer recommended by Locke, who, in places innumerable of his incomparable book, has, without pedantry, even in that pedantic age, made the happieſt application of the rules of logic for unravelling the ſophiſtry of his Jeſuitical antagoniſt.

Upon the whole, then, though we readily acknowledge that much time was waſted by our forefathers in ſyllogiſtic wrangling, and what might with little impropriety be termed the *mechanical* part of logic; yet the art of forming and examining arguments is certainly an attainment not unworthy the ambition of that being whoſe higheſt honour is to be endued with reaſon.

Logiſtæ, Logography.

LOGISTÆ, certain officers at Athens, in number ten, whoſe buſineſs conſiſted in receiving and paſſing the accounts of magiſtrates when they went out of office. The *logiſtæ* were elected by lot, and had ten *euthyni* or auditors of accounts under them.

LOGOGRAPHY, a new method of printing, in which the types, inſtead of anſwering only to ſingle letters, are made to correſpond to whole words.

This method, though ſeemingly a retrograde proceſſion in the printing art, has lately obtained the ſanction of his Majeſty's patent, and has for ſome time been actually put in execution in the way of trade, apparently with advantage to the proprietors. In the year 1783, a treatiſe upon this ſubject appeared by Henry Johnſon, in which the origin as well as the utility of the art are fully laid down, and the matter ſet forth in ſuch a light as can ſcarce allow us to doubt that it is an improvement in the art. Mr Johnſon informs us, that about five years before, viz. in the year 1778, intending to publiſh a daily liſt of blanks and prizes in the lottery numerically arranged, he found it could not be accompliſhed in time by the ordinary way of printing. On this account he procured types of two, three, or more figures as was neceſſary for his purpoſe; and thus any entire number might as readily be taken up as if it had been a ſingle type. His next attempt was in forming ſome large mercantile tables of pounds, ſhillings, pence, and farthings. For theſe he procured types expreſſive of any ſum of money ready compoſed and united, "by which

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which (ſays he) every ſpecies of figure-printing could be performed for the tenth part of the coſt, printers always charging it double the price of letter printing." Having thus ſucceeded to his wiſh in his two firſt attempts, he next began to conſider if the method could not be applied to words; and in this alſo the ſucceſs was equal.

The properties of the logographic art, according to our author, are, 1. That the compoſitor ſhall have leſs charged upon his memory than in the common way. 2. It is much leſs liable to error. 3. The type of each word is as eaſily laid hold of as that of a ſingle letter. 4. The decompoſition is much more readily performed, even by the mereſt novices, than they now decompoſe letters. 5. No extraordinary expence nor greater number of types is required in the logographic than in the common method of printing.

The firſt of theſe poſitions is proved by our author in the following manner. In the common method, the compoſitor has 150 diviſions to which there is no reference, and the printing offices are not agreed with reſpect to the mode of placing their boxes; "but under this improvement, he has only to know the letters of the alphabet, and is aſſiſted with an index of them, inſomuch that the ſimplicity of the latter apparatus enables him, by a little practice, to lay his finger almoſt blindfold on the word required; and the meaneſt capacity is equal to this mental exerciſe, having little more to do than knowing by inſpection the difference between words under three and thoſe above three ſyllables; and all the apparatus being within a compaſs not a great deal more extended than common printing, for theſe reaſons he is as ſoon poſſeſſed of his type of a word as they are of a ſingle letter."

Thus the firſt and third poſitions may be ſaid to be proved; but in his proof of the ſecond, our author himſelf ſhows that his art is not infallible, by ſubſtituting the word *third* inſtead of *ſecond*. Subſtitutions of this kind, he owns, may readily take place; but ſuch errors are much more conſpicuous than literal ones, though they may be corrected with equal eaſe; "for the erroneous ſubſtitution cannot fail of being nearly equal in length to the word required; although, even otherwiſe, it would not be attended with greater diſadvantage than in the common way, and it would be rectified with greater facility."

The eaſe with which the compoſition is performed, ſhows that there muſt be an equal eaſe in performing the decompoſition; "from whence (ſays Mr Johnſon)" it is further demonſtrable, that any work can be compoſed by this method nearly as ſoon as it can be deliberately read; and as to the fifth poſition, that it ſhall not require a greater expence of types, it is anſwered, that it is impoſſible for more types of letters to be wanted for this method than by any other printer according to the equal quantity of buſineſs to be performed, every office having certain known quantities of each letter called a *fount*. A printer's fount contains about 92,500 letters, and our want is not more; nay, nearer the truth, the preſent quantity for a fount containing much more of ſome letters than neceſſary, and fewer of others; which ariſes from the calculation of the quantity of each letter wanted being adhered to ſince the old ſpelling.

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Our author now proceeds to demonſtrate that the number of types muſt neceſſarily decreaſe as they are combined into ſyllables, and much more when formed into words. The whole art of arranging the words conſiſts in placing them under as few diviſions as poſſible, and ſtill fewer ſubdiviſions; which is attained by the following proceſs.

1. A collection of words, with the addition of tenſes, plurals, and degrees of compariſon, amounting to more than 100,000, was made from the beſt Engliſh dictionaries.

2. Collections were made from the miſcellaneous part of 20 newſpapers, the Spectator, and Common Prayer-book. The method was, by procuring duplicates of every ſheet, ſo that each alternate ſide might be paſted over with white paper, in order to leave the whole of the words on both ſides perfect; and thus the whole might be touched with leſs danger of injury than otherwiſe could have been done. The confuſion ariſing from the parts of other words being ſeen from the oppoſite ſide was likewiſe prevented.

3. The words, being ſeparately cut out, were then put into a caſe marked with the diviſions from one to 16, according to the number of letters contained in each word. Thus ſeveral letters were diſtinctly collected; and then each ſeparate parcel ſorted in a caſe containing 26 diviſions, marked with the letters of the alphabet, according to the commencing letter of the word; and thus all the words were ranged alphabetically, conſiſting of two, three, four, or five letters, in ſeparate parcels.

4. The ſame words were then placed together, and poſted into an alphabet, with the number of times marked to each that had occurred on the whole; that in this manner a proportion might be determined how many times particular words ought to be repeated for the printing of one ſheet, and alſo to know what words are in general uſe: There are likewiſe a number of technical terms, and favourite phraſes a great number of times repeated almoſt by every author, but though theſe occur throughout the whole book in great proportion to the reſt, no more of them will be neceſſary than what ſuffice for a ſingle ſheet.

5. The whole of the above might be done without the trouble juſt mentioned, by poſting every word at once into a triformed alphabet; becauſe the ſubdiviſions of the ſecond and third commencing letter of each word for references are now obtained, and thus can eaſily be placed in its proper diviſion, and may be marked as often as it occurs, without repeating the ſame word; whence we plainly ſee the eaſe and expedition of it, from the facility and expedition of poſting every word from a leaf in any book. Before ſuch ſubdiviſions were known, they could only have been placed under the firſt commencing letter of the word; which would cauſe ſuch a multiplicity of repetitions, that it would take up more time, be far more liable to error, and require more ſubordinate poſtings to bring them into arrangement; ſo that they may be found more eaſily than by the above proceedings. Thus alſo a collection will be obtained of ſingle and double words, which are conſtantly required from 20 to 400 or 500 times in the printing one ſheet of any work whatever; and which alone would abridge the compoſitor's work near one-third. This ſecond proceſs likewiſe

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likewiſe enabled the author to reject, out of the firſt collection, obſolete words, technical terms, &c. which reduces the original collection to one fifth part.

6. By proceeding in this manner, ſeveral ſpecies of words are omitted in the founts. 1. Obſolete words; becauſe they occur ſo ſeldom, that the difference of time loſt in compoſing them in the ordinary method would be imperceptible. 2. Technical terms, names of places, animals, &c.; though, for any particular work, the terms peculiar to it may be added to the fount in a biformed alphabet apart. 3. Real compounds, or words that may be compounded of others, are alſo rejected; becauſe we actually have the words already, and they may be joined with ſufficient expedition, though the ſpaces are annexed to each, by being conſtructed accordingly. 4. Thoſe of the ſame ſpelling are likewiſe omitted, though they bear different ſignifications, for obvious reaſons.

7. The variation of tenſes, degrees of compariſon, and numerous words in the Engliſh language, having in general the ſame terminations, ſuch as ED, ING, LY, MENT, NESS, &c. an alphabet may be formed of ſuch a kind as is capable of being annexed to the abſolute words or radices, as expeditiouſly as the whole word could be found in the fount, from its being thereby ſo much leſs extended. Thus, by dividing ſeveral words into their radices and terminations, many other words may be formed from the radix by the addition of various terminations, and each termination may be added to other radices to which they are applicable.

8. Some radices are imperfect, viz. ſuch as end with the vowel *e*, which muſt therefore be added in the uſual way of compoſition. Thus, in the word *adore*, the radix is *ador*, to which the terminations *es*, *ed*, *eſt*, *eth*, *er*, *ing*, may be added occaſionally.

9. By rejecting alſo the words which come under this laſt denomination, the number neceſſary for a fount is reduced to one-tenth of what it would otherwiſe be, as will appear evident from the following conſiderations: 1. There are at leaſt 42 verbs, the infinitive of which ends in *ify*; as *qualify*, *ſignify*; the radices of which are *qual*, *ſign*; the terminations are, *ifies*, *ified*, *ifying*, &c. And Mr Johnſon informs us, that by applying theſe radices to other terminations, he was enabled to diſpenſe with more than 500 words which would otherwiſe have been neceſſary. 2. For all regular verbs, no more than ſix terminations are neceſſary, viz. *s*, *eſt*, *eth*, *ed*, *es*, *ing*. There are but few irregular ones in the Engliſh language; whence it happens that 12 or 14 words may be formed from one ſingle perfect verb as a radix, and many imperfect ones ſave double that number.

10. By uſing only the ſet of terminations which may be contained in a box of two feet ſquare, the common operation of printing would be ſhortened nearly one half; and in order to find out thoſe which are moſt in uſe, and fitteſt to retain, our author digeſted them alphabetically, with the radices, words, or ſyllables, which make complete words annexed to them. Thus,

tain	abs—apper—aſcer
——s	de—dis—con
——ed	cer—cap—cur
——ing	enter—main—re—ſus, &c.
——ment	

11. Thus it will be found, that out of more than 100,000 words of which the Engliſh language conſiſts, there will not be wanted much above 3500 for a complete fount. This will be very evident to any perſon who conſults a dictionary. He will there find, that a vaſt number of words require an explanation; whereas in any miſcellaneous work, there are none but what can be underſtood moſt readily either together or apart. Newſpapers retain more of the uncommon kind of words than any others. "The vocabulary (ſays our author) or alphabet as it is called, of the Chineſe, conſiſts of above 80,000 letters or characters; yet he is admitted a maſter of the language who knows about 4000 of them, no more being in general uſe."

The expedition with which the logographic method of printing can be accompliſhed, depends eſſentially on their arrangement; which, from great numbers of experiments, our author found to be beſt accompliſhed in the following manner: 1. Words of one, two, or three ſyllables, are alphabetically placed by themſelves, including all poſſible commencing ſyllables, by which the compoſitor cannot fail of finding the word either in whole or in part let it be what it will; and when the whole cannot be found at once, the remainder may eaſily be found in ſingle or double ſyllables among the terminations. 2. All words above three ſyllables have the ſame alphabetical arrangement; the terminations being the ſame at the bottom of each. Experience ſhows, that by a very few leſſons, the meaneſt capacity may determine the number of ſyllables, and refer to the particular caſe containing words of that number, there being conſpicuous references to each; and by thus equalizing them, any perſon may poſſeſs himſelf very expeditiouſly of what he wants. Even boys who ſcarce knew more than the letters of the alphabet, were hardly a fortnight employed in this method, when they could at the firſt glance tell the number of letters contained in any word.

By this ſimplicity of arrangement, any intelligent perſon, who never compoſed in his life, by being placed in a room with the apparatus, could compoſe and print, without other previous inſtruction than deſiring him to remember that the words under three ſyllables, and thoſe above three, are placed in ſeparate alphabets; and that whenever he wants a word, the firſt letter is ſeen in capitals of two inches on the walls, the ſecond in letters of one inch in right lines; and where it is neceſſary to have more columns than one for ſuch ſecond letter, the third is given in red down the column, comprehending about 12 diviſions, to contain the types of the word coming under ſuch reference.

To exemplify this method as far as it can be done without actually ſeeing the apparatus, our author inſtances the two words *Above* and *Unfortunately*. In looking for the former, the firſt letter, A, is ſeen upon the wall as already mentioned; the ſecond, B, is on the caſe under it, and down that column is OVE, oppoſite to the cell containing the types of the whole word; which would be only three references inſtead of five with ſpaces, as in the common method. The other word, viz. *Unfortunately*, may be found by the ſame references, though it contains 13 letters; but "admitting that practice will give the word as ſoon as a ſingle letter, the average will be found eight for one."—Our author's explanation of the method in which this word might be compoſed, however, ſeems

by

Logography.

by no means intelligible.—"For this diſtinction in the caſes (ſays he), the alphabet, or rather marks of firſt reference in large characters on the wall, is divided into two claſſes, not as vowels and conſonants, but as follows, *viz.* A, Con, Diſ, E, In, O, P, S, Un, commencing references, the ſecond or ſubſequent letters of the words being in a right line from left to right, and down each column is found the remainder of the reference to the words, diſtinguiſhing always the third letter in red. The ſecond diſtinction is, that for all other commencing letters, the ſecond letter of reference is in a column down, and the third letter in lines from left to right in red.

Theſe are the directions given by our author for forming a fount of words; the next requiſite is a fount of ſyllables, formed in the following method: 1. A complete ſet of two letters was obtained in all their poſſible combinations, amounting to 676. 2. Having next obtained the poſſible combination of theſe letters, *viz.* 17576, by retaining only all poſſible ſyllables, and words of three letters, it is reduced to the 30th part, which anſwer all the purpoſes of compoſing with ſyllables of two and three letters, for Latin, French, Engliſh, and all names of perſons, places, and things, every poſſible ſyllable being comprehended among them. Hence it forms an univerſal triformed alphabet, where Engliſh characters are uſed; from whence all partial biformed and triformed alphabets in the arrangement of Engliſh, French, Latin, and all technical matters, are drawn. Though combinations of four letters are again 26 times the number of thoſe of three letters, and five letters increaſe in the ſame ratio; yet as much as all poſſible combinations increaſe in quantity proportionate to the number of letters combined, ſo they decreaſe in the actual number of ſyllables included among them, inſomuch, that all the ſyllables of four, five, ſix, and ſeven letters together, are conſiderably fewer than the ſyllables of three letters only.—Beſides the two founts already mentioned, a third was found neceſſary for ſuch terminations as are moſt commonly followed by particular punctuations; but, after ſome conſideration, this was judged unneceſſary.

Our author now proceeds to obviate ſome objections which muſt naturally occur to one who firſt hears of his invention. Theſe are,

1. A ſingle letter damaged in a word renders the whole uſeleſs.

This is not denied by Mr Johnſon; but he contends, that the quantity of metal loſt in this manner is quite trifling.

2. How are the blanks or ſpaces in a line to be managed, as theſe are by no means equal?

To this our author replies, that, at the time of writing the pamphlet, he was undetermined whether it be moſt eligible to have ſpaces caſt along with the beginnings of words, or to ſpace them in the common manner. The former would be more expeditious; and where a greater diſtance is required, other ſpaces may be introduced in the ordinary method.

3. How is a long word at the end of a line to be divided?

This may be eaſily accompliſhed by means of the ſyllabic fount already mentioned.

4. How is the error of ſubſtituting one word for another to be rectified?

The anſwer to this is, that an error of the kind ſpecified may be corrected in the very ſame manner as is done in common printing. Long words may be divided by means of the ſyllabic fount already mentioned, and the intervals between the words may be filled up with *ſpaces* as uſual. Logography, Lolium.

LOGWOOD. See HÆMATOXYLON.

LOHOCH, or LOCH, in pharmacy, a compoſition of a middle conſiſtence between a ſoft electuary and a ſyrup, principally uſed in diſorders of the lungs.

LOINS, in anatomy, the two lateral parts of the umbilical region of the abdomen.

LOIRE, the largeſt river in France, riſes in the mountains of the Cevennes, and, after running a courſe of about 500 miles, falls into the bay of Biſcay.

LOKE, in mythology, the name of one of the deities of the northern nations, anſwering to the Arimanes among the Perſians, whom they repreſent as at enmity both with gods and men, and the author of all the evils which deſolate the univerſe. Loke is deſcribed in the Edda as producing the great ſerpent which incircles the world; which ſeems to have been intended as an emblem of corruption or ſin: he alſo gives birth to Hela or death, the queen of the infernal regions; and alſo to the wolf Fenris, that monſter who is to encounter the gods and deſtroy the world.

LOKMAN the WISE, an eminent philoſopher among the Eaſterns. The Arabians ſay he was the ſon of Baura, the ſon or grandſon of a ſiſter or aunt of Job. He was an Ethiopian, and a ſlave for ſome time. It is related that he was born in the time of David, and lived till the age of the prophet Jonas. Some ſuppoſe him to have been the ſame with Æſop the mythologiſt: and indeed we find in the parables or apologues of Lokman in Arabic, many particulars that are ſeen in Æſop's fables; ſo that it is not eaſy to determine whether the Greek or the Arabian are the originals. He is ſaid to have been deformed in his perſon; but that this defect was ſufficiently made up by the perfections of his mind. Some pieces of his are extant; and he was looked upon as ſo excellent a perſon, that Mahomet has inſerted a chapter of the Koran, called after his name, in which he introduces God as ſaying, "We heretofore beſtowed wiſdom on Lokman."—It is related that he got his liberty on the following occaſion. His maſter having given him a bitter melon to eat, he eat it all. His maſter, ſurpriſed at his exact obedience, aſked, How it was poſſible for him to eat ſuch a nauſeous fruit? He anſwered, "I have received ſo many favours from you, that it is no wonder I ſhould once in my life eat a bitter melon from your hand." This generous anſwer of the ſlave ſtruck the maſter to ſuch a degree, that he immediately gave him his liberty. M. Galland tranſlated all the fables of Lokman, and Bidpai or Pilpay a bramin philoſopher, which were publiſhed at Paris in 1724.

LOLIUM, DARNEL-GRASS, in botany: A genus of the digynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 4th order, *Gramina*. The calyx is monophyllous, fixed, and uniflorous. The moſt remarkable ſpecies are, 1. The perenne, red darnel, or rye-graſs. This is very common in roads and dry paſtures. It makes excellent hay upon dry, chalky, or ſandy ſoils. It is advantageouſly cultivated along with clover, and

ſprings

Lollards. springs earlier than other graſſes; thereby ſupplying food for cattle at a time when it is moſt difficult to be obtained. Cows, horſes, and ſheep eat it; goats are not fond of it. 2. The temulentum, or white darnel, grows ſpontaneouſly in ploughed fields. If the ſeeds of this ſpecies are malted with barley, the ale ſoon occaſions drunkenneſs; mixed with bread-corn, they produce but little effect unleſs the bread is eaten hot.

LOLLARDS, in eccleſiaſtical hiſtory, a religious ſect, differing in many religious points from the church of Rome, which aroſe in Germany about the beginning of the 14th century; ſo called, as many writers have imagined, from Walter Lollard, who began to dogmatiſe in 1315, and was burnt at Cologn: though others think that Lollard was no ſurname, but merely a term of reproach applied to all heretics who concealed the poiſon of error under the appearance of piety.

The monk of Canterbury derives the origin of the word Lollard among us, from *lolium*, "a tare;" as if the Lollards were the tares ſown in Chriſt's vineyard. Abelly ſays, that the word Lollard ſignifies "praiſing God," from the German *loben*, "to praiſe," and *herr*, "Lord;" becauſe the Lollards employed themſelves in travelling about from place to place, ſinging pſalms and hymns.

Others, much to the ſame purpoſe, derive *lollhard*, *lullhard*, or *lollert*, *lullert*, as it was written by the ancient Germans, from the old German word *lullen*, *lollen*, or *lallen*, and the termination *hard*, with which many of the High Dutch words end. *Lollen* ſignifies "to ſing with a low voice," and therefore Lollard is a ſinger, or one who frequently ſings; and in the vulgar tongue of the Germans it denotes a perſon who is continually praiſing God with a ſong, or ſinging hymns to his honour. The Alexians or Cellites were called *Lollards*, becauſe they were public ſingers who made it their buſineſs to inter the bodies of thoſe who died of the plague, and ſang a dirge over them in a mournful and indiſtinct tone as they carried them to the grave. The name was afterwards aſſumed by perſons that diſhonoured it; for we find, among thoſe Lollards who made extraordinary pretences to piety and religion, and ſpent the greateſt part of their time in meditation, prayer, and ſuch acts of piety, there were many abominable hypocrites, who entertained the moſt ridiculous opinions and concealed the moſt enormous vices under the ſpecious mark of this extraordinary profeſſion. And many injurious aſperſions were propagated againſt thoſe who aſſumed this name by the prieſts and monks; ſo that, by degrees, any perſon who covered hereſies or crimes under the appearance of piety, was called a *Lollard*. Thus the name was not uſed to denote any one particular ſect, but was formerly common to all perſons and all ſects who were ſuppoſed to be guilty of impiety towards God or the church, under an external profeſſion of extraordinary piety. However, many ſocieties, conſiſting both of men and women under the name of *Lollards*, were formed in moſt parts of Germany and Flanders, and were ſupported partly by their manual labours, and partly by the charitable donations of pious perſons. The magiſtrates and inhabitants of the towns where theſe brethren and ſiſters reſided, gave them particular marks of favour and protection, on account of their great uſefulneſs to the ſick and needy. They were thus ſupported againſt their malignant rivals, and obtained many papal conſtitutions by which their inſtitute was confirmed, their perſons exempted from the cogniſance of the inquiſitors, and ſubjected entirely to the juriſdiction of the biſhops; but as theſe meaſures were inſufficient to ſecure them from moleſtation, Charles duke of Burgundy, in the year 1472, obtained a ſolemn bull from Pope Sixtus IV. ordering that the Cellites or Lollards ſhould be ranked among the religious orders, and delivered from the juriſdiction of the biſhops; and Pope Julius II. granted them yet greater privileges in the year 1506. Moſheim informs us that many ſocieties of this kind are ſtill ſubſiſting at Cologn, and in the cities of Flanders, though they have evidently departed from their ancient rules. Lollards || Lombards.

Lollard and his followers rejected the ſacrifice of the maſs, extreme unction, and penances for ſin; arguing, that Chriſt's ſufferings were ſufficient. He is likewiſe ſaid to have ſet aſide baptiſm, as a thing of no effect; and repentance, as not abſolutely neceſſary, &c.—In England, the followers of Wickliffe were called, by way of reproach, *Lollards*, from ſome affinity there was between ſome of their tenets; though others are of opinion, that the Engliſh Lollards came from Germany.

They were ſolemnly condemned by the archbiſhop of Canterbury and the council of Oxford.

LOMBARD (Lambert), an eminent painter, born at Liege in 1500; who, after a diligent ſtudy of the antique at Rome, introduced that ſtyle of painting among his countrymen inſtead of the Gothic. He painted hiſtory, architecture, and perſpective; and though he could never altogether free himſelf from his national goût, he is ranked among the beſt painters of his time. He died in 1560.

Lombard (Peter), well known by the title of *Maſter of the Sentences*, was born at Novara in Lombardy; but being bred at Paris, he diſtinguiſhed himſelf ſo much at that univerſity, that he firſt had the canonry of Chartres conferred on him, was ſome time tutor to Philip ſon of Louis le Gros, and laſtly obtained the ſee of Paris. He died in 1164. His work of the Sentences is looked on as the ſource of the ſcholaſtic theology of the Latin church. He wrote alſo Commentaries on the Pſalms, and on St Paul's Epiſtles.

LOMBARDS, a Scandinavian nation, who formerly ſettled in Italy, and for ſome time made a conſiderable figure.

I

Etymology of the name.

Their name of *Lombards*, or *Longobards*, is by ſome derived from the word *lack*, or *lache*, ſignifying in the German tongue *winter*; becauſe the Lombards, while in Scandinavia, lived in marſhes, or near the ſea. Others think that it comes from the two German words *langen barden*, or *helleborden*, that is, from the long halberts they were ſuppoſed to uſe in war. But Paulus Diaconus their hiſtorian, and who was himſelf a Lombard, tells us, that they were called *Longobards* from the length of their beards. A nation called the *Lombards* is mentioned by Tacitus, Strabo, and Ptolemy; but theſe are different from the Lombards who afterwards ſettled in Italy, and are reckoned to be the ſame with

Lombards.

the Gepidæ, whom the Italian Lombards almoſt exterminated. The Lombards who ſettled in Italy are firſt mentioned by Proſper Aquitanus, biſhop of Rhegium in the year 379. That writer tells us, that about this time the Lombards, abandoning the moſt diſtant coaſts of the ocean, and their native country Scandinavia, and ſeeking for new ſettlements, as they were overſtocked with people at home, firſt attacked and overcame about this time the Vandals in Germany. They were then headed by two chiefs, Iboreus and Aion; who, dying about the year 389, were ſucceeded by Agilmund, who is commonly reckoned the firſt king of the Lombards.

2 Vandals defeated by the Lombards.

Before the time of Odoacer, the Lombard hiſtory affords nothing remarkable; in his time, however, they ſettled on the Danube, in the country of the Rugians, whom Odoacer had almoſt totally exterminated or carried into captivity. During their ſtay in this country, they rendered themſelves formidable to the neighbouring nations, and carried on ſucceſsful wars with the Heruli and Gepidæ. In 526, they were allowed by the emperor Juſtinian to ſettle in Pannonia; and here they made war a ſecond time with the Gepidæ. Alboinus, the Lombard king, killed the king of the Gepidæ with his own hand, put his army to the rout, and cut ſuch numbers of them in pieces, that they ceaſed from that time to be a nation. Having cauſed the deceaſed king's head to be cut off, he made a cup of his ſkull, called in the language of the Lombards *ſchala*, which he made uſe of in all public entertainments. However, having taken, among many other captives of great diſtinction, the late king's daughter, by name *Roſamunda*, he married her after the death of his former wife Clodiſvinta, the daughter of Clotaire king of France.

3 They ſettle in the country of the Rugians.

4 Deſtroy the Gepidæ.

By this victory Alboinus gained ſuch reputation, that his friendſhip was courted by Juſtinian; and, in conſequence of the emperor's application, a body of 6000 Lombards were ſent to the aſſiſtance of Narſes againſt the Goths. The ſucceſs of the Romans in this expedition, the invaſion of Italy by the Lombards, and their ſucceſſes in that country, have been taken notice of under the article ITALY, n° 28—32. At laſt Alboinus, having made himſelf maſter of Venetia, Liguria, Æmilia, Hetruria, and Umbria, was ſlain by the treachery of his wife, in the year 575, the fourth of his reign. This princeſs was the daughter of the king of the Gepidæ, whom Alboinus had killed in battle, and made a cup of his ſkull, as above related. As he was one day feaſting at Verona with his chief favourites and principal officers, in the height of his mirth he ſent for the queen, and, filling the deteſted cup, commanded her to drink merrily with her father. Roſamund, ſtruck with horror, hurried out of the room; and highly incenſed againſt her huſband for thus barbarouſly triumphing over the misfortunes of her family, reſolved, at all events, to make him pay dear for ſuch an inhuman and affronting conduct. Accordingly, ſhe diſcovered her intention to Helmichild the king's ſhield-bearer, a youth of great boldneſs and intrepidity. Helmichild preremptorily refuſed to imbrue his hands in the blood of his ſovereign, or to be any way acceſſory to his death; and in this reſolution he perſiſted till he was, by a ſhameful ſtratagem, forced by the queen to a compliance: for ſhe, knowing that he carried on an intrigue with one of her ladies, placed herſelf one night in her bed, and receiving the youth, indulged him as if ſhe had been his own miſtreſs in his amorous deſires; which ſhe had no ſooner done, than, diſcovering herſelf to the deceived lover, ſhe told him that he muſt now either put the king to death, or be put to death by him. Helmichild, well appriſed, that, after what he had done, his ſafety depended upon the death of the king, engaged in the treaſon, which he otherwiſe abhorred. One day, therefore, while Alboinus was repoſing in his chamber after dinner, Helmichild, with ſome others whom he had made privy to his deſign, breaking in unexpectedly, fell upon the king with their daggers. Alboinus, ſtarting up at their firſt coming in, laid hold of his ſword, which he had always by him; but having in vain attempted to draw it, the queen having beforehand faſtened it in the ſcabbard, he defended himſelf for ſome time with a footſtool; but was in the end overpowered, and diſpatched with many wounds.

5 Alboinus king of the Lombards aſſaſſinated at the inſtigation of his wife.

Roſamund had promiſed to Helmichild, that, as ſoon as he had diſpatched the king, ſhe would marry him, and, with her perſon, beſtow upon him the kingdom of the Lombards. The firſt part of her promiſe ſhe immediately performed; but was ſo far from being able to beſtow the crown upon him, that both of them were obliged to ſave themſelves by flight. They fled to Longinus the exarch of Ravenna, taking with them all the jewels and treaſure of the late king. Longinus received her with the greateſt marks of friendſhip and kindneſs, and aſſured her of his protection. She had not been long in Ravenna, however, before the exarch, judging that a favourable opportunity now offered of making himſelf king of Italy by her means, imparted his deſign to her, and declared his intention to marry her, provided, by ſome means or other, ſhe diſpatched Helmichild.—Roſamund, highly pleaſed with the propoſal, reſolved to ſatisfy her ambition by getting rid of the perſon whom ſhe had married in order to gratify her revenge. Accordingly, having prepared a ſtrong poiſon, ſhe mixed it with wine, and gave it to her huſband as he came out of the bath, and called for drink, according to his cuſtom. Helmichild had not half emptied the cup, when, by the ſudden and ſtrange operation which he felt in his bowels, he concluded what it was; and, with his ſword pointed at the queen's breaſt, compelled her to drink the reſt. The poiſon had the ſame effect on both; for they died in a few hours. Longinus, on the death of the queen, laid aſide all thoughts of making himſelf king of Italy, and ſent the king's treaſure to Conſtantinople, together with Albiſoinda, the daughter of Alboinus by Roſamund, whom ſhe had brought along with her.

6 Her death.

After the death of Alboinus, the Lombards choſe Clephis, one of the nobility, for their king. He was murdered after a ſhort reign of 18 months; upon which enſued an interregnum of 10 years, as related under the article ITALY, n° 32. During this time, they extended their conqueſts in that country; but at laſt the Romans, jealous of their progreſs, reſolved to put a ſtop to their victories, and, if poſſible, to drive them quite out. For this purpoſe, they deſigned not only to employ their own force, but entered into alliance with the Franks; which ſo alarmed the Lombards, that they re-eſtabliſhed the monarchical form of government

7 Monarchy aboliſhed.

Lombards. vernment among themſelves, and choſe Autharis the ſon of Clephis for their king. This monarch, conſidering that the power of the dukes, who had governed Lombardy for the ſpace of 10 years, was during that length of time very much eſtabliſhed, and that they would not probably be willing to part with the authority which they had ſo long enjoyed, allowed them to continue in their government; but obliged them to contribute one moiety of their revenues towards the maintenance and ſupport of his royal dignity, ſuffering them to diſpoſe of the other as they thought proper. He reſerved to himſelf the ſupreme dominion and authority; and took an oath of the dukes, that, in time of war, they would readily aſſiſt him to the utmoſt of their power. Though he could remove the dukes at pleaſure, yet he deprived none of them of their dukedoms, except in caſes of treaſon; nor gave them to others, except when their male iſſue failed. Having ſettled matters in this manner with the dukes, he enacted ſeveral wholeſome laws againſt theft, rapine, murder, adultery, and other vices which prevailed among his ſubjects, and was the firſt of the Lombard kings who embraced Chriſtianity. Moſt of his ſubjects followed the example of their monarch: but as they were all inſtructed by Arian biſhops, they continued long infected with that hereſy; which occaſioned great diſputes between them and the orthodox biſhops of the cities ſubject to them.

8 Reſtored

From the re-eſtabliſhment of the monarchy under Autharis, to the reign of Rotharis in 636, the hiſtory of the Lombards affords nothing memorable. This period is remarkable for the introduction of written laws among theſe people. Before his time they had been governed only by tradition; but Rotharis, in imitation of the Romans and Goths, undertook the publiſhing of written laws; and to thoſe which he enacted, many were added by the ſucceeding princes. Grotius prefers the method which the Lombards followed in making laws, to that which was practiſed by the Romans themſelves. Among the latter the emperor was the ſole lawgiver; ſo that whatever pleaſed him had the force of a law. But the Lombard kings did not aſſume that power to themſelves, ſince their laws were enacted in public aſſemblies, convened for that purpoſe, after they had been maturely examined and approved of by all the lords of the kingdom. From theſe aſſemblies were excluded the eccleſiaſtic order, and the people; ſo that the legiſlative power was lodged in the king and nobles alone.

9 Written laws when firſt introduced.

The reign of Rotharis is remarkable, not only for his introducing written laws among his ſubjects, but for the conqueſts he made, and the ſucceſsful wars carried on with the exarch of Ravenna, whom he totally defeated in ſeveral engagements, and made himſelf maſter of ſome part of his territories. This monarch died in 652; and the affairs of the Lombards went on proſperouſly, till the ambition of Luitprand laid the foundation of the total ruin of his kingdom.

10 Luitprand's ambition.

He aſcended the throne of Lombardy in 711, and watched all opportunities of enlarging his dominions at the expence of the emperors. Of this, a fair opportunity offered in 716: for the emperor Leo Iſauricus, who at that time reigned in the eaſt, having, by his famous edict, forbidden the worſhip of images, and ordered them to be every where pulled down, the people were ſo provoked at that innovation, that, in Lombards. ſeveral places, they openly revolted, and, falling upon the emperor's officers, drove them out of the cities. In the eaſt, Germanus, patriarch of Conſtantinople, oppoſed the emperor's deſign with great warmth; but Leo cauſed him to be depoſed, and Anaſtaſius to be raiſed to that ſee in his room, ordering at the ſame time all the images in the imperial city to be pulled down and publicly burnt. He ſtrictly enjoined his officers in the weſt, eſpecially the exarch of Ravenna, to ſee his edict punctually obeyed in their reſpective governments. In compliance with theſe orders, Scholaſticus, then exarch, began to pull down the images in all the churches and public places in Ravenna; which incenſed the ſuperſtitious multitude to ſuch a degree, that, taking arms, they openly declared they would rather renounce their allegiance to the emperor than the worſhip of images.

Thus a kind of civil war being kindled in the city, Luitprand thought he had now a favourable opportunity of making himſelf maſter of the ſeat of the exarch, not doubting but the conqueſt of ſuch an important place would be followed by that of the whole exarchate. Having therefore drawn together all his forces, he unexpectedly appeared before Ravenna, and cloſely beſieged it. The exarch little expected ſuch a ſurpriſe, as a friendly correſpondence had been maintained for many years between the exarchs and the Lombard kings. However, he defended the place with ſuch courage and reſolution, that Luitprand, deſpairing of ſucceſs, broke up the ſiege and led his army againſt Claſſis, at a ſmall diſtance from Ravenna, which he took, plundered, and levelled with the ground. The loſs of this place, and the ſevere treatment the inhabitants met with from the king, threw the citizens of Ravenna into the utmoſt conſternation; which Luitprand being informed of, he reſolved to take advantage of their fears, and, returning before Ravenna while the inhabitants were thus diſheartened, to attempt once more the reduction of that place. Accordingly he led his whole army againſt it, and, by frequent attacks, tired the inhabitants and garriſon to ſuch a degree, that the exarch, finding they could hold out no longer, and deſpairing of relief, privately withdrew. Luitprand, informed of his retreat, attacked the town with more violence than ever; and, having carried it by ſtorm, gave it up to be plundered by his ſoldiers, who found in it an immenſe booty, as it had been for a long time the ſeat of the Roman emperors, of the Gothic kings, and the exarchs. The king ſtripped it of moſt of its valuable monuments of antiquity, and cauſed, among the reſt, an equeſtrian ſtatue of an emperor, of wonderful workmanſhip, to be conveyed to Pavia, where it is to be ſeen to this day. The reduction of Ravenna was followed by the ſurrender of ſeveral cities of the exarchate, which Luitprand reduced to a dukedom; appointing Hildebrand his grandſon to govern it with the title of duke; and giving him, as he was yet an infant, Peredeus duke of Vicenza for his guardian.

11 He beſieges and at laſt takes Ravenna.

12 Reduces the exarchate to a dukedom.

The conqueſt of Ravenna and the greater part of the exarchate did not a little alarm Gregory II. biſhop of Rome. He was then at variance with the emperor, whoſe edict againſt the worſhipping of images he had oppoſed with all his might, and by that

Lombards. means provoked Leo to ſuch a degree, that he had threatened to drive him from the ſee, and ſend him into exile. However, the pope, no leſs jealous of the power of the Lombards than all his predeceſſors had been, reſolved, by ſome means or other, to put a ſtop to their conqueſts. The only prince in Italy to whom he could have recourſe was Urſus duke of Venice, the Venetians making already no inconſiderable figure.

13 The exarch aſſiſted by the Venetians. To him accordingly he wrote a very preſſing letter; conjuring him to aſſiſt his worthy ſon the exarch, and, for the love of the holy faith, to attempt with him the recovery of the exarchate, which the wicked nation of the Lombards had unjuſtly taken from his ſons Leo and Conſtantine emperors. Urſus and the Venetians, moved with the pope's letter, and at the ſame time greatly alarmed at the growth of ſo powerful a neighbour, promiſed to aſſiſt the exarch with the whole ſtrength of their republic; and accordingly fitted out a conſiderable fleet, pretending it was deſigned for the ſervice of the emperor againſt the Saracens. At the ſame time the exarch, who had taken refuge in Venice, abandoning that place, as it were in deſpair of bringing the duke over to his party, raiſed, in the places ſtill ſubject to the emperor, what forces he was able; and having got together a conſiderable body, he marched with them towards Imola, giving out that he deſigned to beſiege that city; but, turning on a ſudden towards Ravenna, as had been agreed on between him and the Venetians, he laid ſiege to it by land, while they inveſted it almoſt at the ſame inſtant by ſea. Peredeus defended the town for ſome time with great courage and reſolution; obliging all thoſe who were able to bear arms to repair to the walls. But the Venetians having, in ſpite of all oppoſition, forced open one of the gates on the ſide of the ſea, the city was taken, and Peredeus ſlain, while he was attempting, at the head of a choice body, to drive the enemy from the poſts they had ſeized. As for Hildebrand, he fell into the hands of the Venetians; who, having thus recovered Ravenna to the emperor, returned home, leaving the exarch in poſſeſſion of the city. Luitprand was then at Pavia; but the town was taken before he could aſſemble his troops to relieve it.

14 Who retake Ravenna.

And now Gregory biſhop of Rome, to whom the recovery of Ravenna was chiefly owing, perſuading himſelf, that the emperor would, out of gratitude, give ear to his remonſtrances and admonitions, began to ſolicit him with more preſſing letters than ever to revoke his edict againſt the worſhip of images: but Leo, well appriſed that the biſhop, in all the meaſures he had taken, had been more influenced by a regard to his own intereſt, than to that of the empire, inſtead of hearkening to his remonſtrances, was ſtill more provoked againſt him for thus obſtinately oppoſing the execution of his edict. Being, therefore, reſolved at all events to have it obſerved in Rome itſelf, and, on the other hand, not doubting but the pope would oppoſe it to the laſt with all his might; in order to remove all obſtacles, he ſent three officers to Rome, with private orders, either to diſpatch the pope, or to take him priſoner and convey him to Conſtantinople. At the ſame time, he wrote to Mauritius duke of Rome, ſecretly enjoining him to aſſiſt his three officers in their undertaking: but no favourable opportunity offering to put their deſign in execution, the emperor, in the year 725, recalled Scholaſticus, and ſent Paul a patrician into Italy, to govern in his room, with private inſtructions to encourage the above-mentioned officers with the promiſe of great rewards, and to aſſure them of his protection. Lombards.

But, in the mean time, the plot was diſcovered, and two of the conſpirators were apprehended by the citizens of Rome, and put to death; the third having eſcaped into a monaſtery, where he took the monaſtic habit, and ended his days. Hereupon the exarch, in compliance with the emperor's orders, reſolved to proceed no longer by ſecret plots, but by open force. Accordingly, he drew together a conſiderable body of troops, and ſet out at the head of them on his march to Rome, with a deſign to ſeize on the pope, and ſend him, as he had engaged to do, in chains to Conſtantinople. But, on this occaſion, Luitprand, though highly provoked againſt Gregory for having ſtirred up the Venetians againſt him, yet reſolved to aſſiſt him and the citizens of Rome againſt the exarch, in order to keep the balance even between them, and by aſſiſting ſometimes the one and ſometimes the other, weaken both. Purſuant to this reſolution, he ordered the Lombards of Tuſcany, and thoſe of the dukedom of Spoleto, to join the pope and the inhabitants of Rome; who, being by this reinforcement far ſuperior in ſtrength and number to the exarch, obliged him to return to Ravenna, and give over all thoughts of any further attempt on the perſon of the pope.

15 Luitprand aſſiſts the pope againſt the exarch.

In the mean time, Leo, perſiſting in his former reſolution of ſuppreſſing throughout his dominions the worſhip of images, ſent freſh orders to the exarch Paul, ſtrictly enjoining him to cauſe his edict to be put in execution in all the cities of Italy under his empire, eſpecially in Rome. At the ſame time, he wrote to the pope, promiſing him his favour and protection if he complied with the edict; and declaring him, if he continued to oppoſe it, a rebel, and no longer veſted with the papal dignity. But Gregory was ſo far from yielding to the emperor's threats or promiſes, that, on the contrary, he ſolemnly excommunicated the exarch for attempting to put the imperial edict in execution; and at the ſame time wrote circular letters to the Venetians, to king Luitprand, to the Lombard dukes, and to all the chief cities of the empire, exhorting them to continue ſtedfaſt in the Catholic faith, and to oppoſe with all their might ſuch a deteſtable innovation. Theſe letters made ſuch an impreſſion on the minds of the people in Italy, that, though of different intereſts, and often at war with one another, they all united; proteſting they would defend the Catholic faith, and the life of the pope, in ſo glorious a cauſe, at the expence of their own: nay, the citizens of Rome, and the inhabitants of Pentapolis, now Marca d' Ancona, not contenting themſelves with ſuch a proteſtation, openly revolted from the emperor; and, pulling down his ſtatues, they elected, by their own authority, magiſtrates to govern them during the interregnum. We are even told, that, tranſported with a blind zeal, they were for chooſing a new emperor, and conducting him to Conſtantinople, not doubting but the people would every-where join them. But the pope, thinking this reſolution unſeaſonable, and not to be eaſily put in execution, oppoſed it; ſo that it did not take place.

In

Lombards.

In the mean time, the exarch Paul, having gained a conſiderable party in Ravenna, began, purſuant to the repeated orders from the emperor, to remove the images, as ſo many idols, out of the churches. Hereupon the adverſe party, ſupported and encouraged by the pope, flew to arms; and, falling upon the *iconoclaſts* or image-breakers, as they ſtyled them, gave riſe to a civil war within the walls of Ravenna. Great numbers were killed on both ſides: but thoſe who were for the worſhip of images prevailing in the end, a dreadful ſlaughter was made of the oppoſite party; and, among the reſt, the exarch himſelf was murdered. However, the city of Ravenna continued faithful to the emperor; but moſt of the cities of Romagna belonging to the exarchate, and all thoſe of Pentapolis or La Marca d'Ancona, abhorring the emperor as an heretic, ſubmitted to Luitprand king of the Lombards; who, pretending a zeal for the Catholic religion, took care to improve the diſcontent of the people to his advantage, by repreſenting to them, that they could never maintain their religious rights under a prince, who was not only an heretic, but a perſecutor of the orthodox.

16 A civil war in Ravenna

In Naples, Exhilaratus, duke of that city, having received peremptory orders from the emperor to cauſe his edict to be put in execution, did all that lay in his power to perſuade the people to receive it; but finding all his endeavours thwarted by the biſhop of Rome, for whom the Neapolitans had a great veneration, he hired aſſaſſins to murder him. But the plot being diſcovered, though carried on with great ſecrecy, the Neapolitans, highly provoked againſt the duke, tore both him and his ſon to pieces, and likewiſe put to death one of his chief officers, who had compoſed a libel againſt the pope. Luitprand, and Gregory at that time duke of Benevento, laying hold of ſo favourable an opportunity to make themſelves maſters of the dukedom of Naples, did all that lay in their power to perſuade the Neapolitans to ſubmit to them. But the Neapolitans, bearing an irreconcileable hatred to the Lombards, with whom they had been conſtantly at variance, rejected every overture of that nature with the utmoſt indignation; and, continuing ſtedfaſt in their allegiance to Leo, received from Conſtantinople one Peter, who was ſent to govern them in the room of Exhilaratus. Some writers ſuppoſe the Neapolitans, in this general revolt of the cities of Italy, to have ſhaken off the yoke with the reſt, and to have appointed magiſtrates of their own election to govern them, in the room of the officers hitherto ſent from Conſtantinople, or named by the exarch: but they are certainly miſtaken; it being manifeſt from hiſtory, that Peter ſucceeded Exhilaratus in that dukedom, and that the Neapolitans continued to live under the emperors, till they were conquered many years after by the Normans.

In the mean time, Leo hearing of the murder of the exarch, and the general revolt of the cities, and not doubting but the pope was the chief author of ſo much miſchief, ſent the eunuch Eutychius into Italy, with the title and authority of *exarch*, ſtrictly enjoining him to get the pope diſpatched by ſome means or other, ſince his death was abſolutely neceſſary for the tranquillity of Italy. The exarch ſpared no pains to get the pope into his power; but a meſſenger, whom he had ſent to Rome, being apprehended by the citizens, and an order from the emperor being found upon him to all his officers in that city, commanding them to put the pope to death at all events, the pope's friends thenceforth guarded him with ſuch care, that the exarch's emiſſaries could never afterwards find an opportunity of executing their deſign. As for the meſſenger, the Romans were for putting him to death; but the pope interpoſed, contenting himſelf with excommunicating the exarch.

Lombards.

17 The Romans revolt.

And now the Romans, provoked more than ever againſt Leo, and, on the other hand, unwilling to live under the Lombards, reſolved to revolt from the emperor, and appoint their own magiſtrates, keeping themſelves united under the pope, not yet as their prince, but only as their head. This they did accordingly; and from theſe ſlender beginnings the ſovereignty of the popes in Italy took its riſe, though they did not then, as is commonly ſuppoſed by hiſtorians, but many years after, become ſovereign lords of Rome.

Eutychius failed in his deſign upon the life of the pope; but having brought with him from Conſtantinople a good number of troops, he eaſily quelled the rebellion in Ravenna, and ſeverely puniſhed the authors of the late diſturbances. As for the rebellious Romans, he was well appriſed he could never reduce them, ſo long as they were ſupported by the king of the Lombards; and therefore he employed all his art and policy to take off that prince from the party of the Romans, and bring him over to his own.

18 Luitprand concludes an alliance with the exarch.

Luitprand, for ſome time, withſtood all his offers; but Thraſimund duke of Spoleto revolting at this very juncture, the exarch, laying hold of that opportunity, offered to aſſiſt the king with all his ſtrength againſt the rebellious duke, provided he would, in like manner, aſſiſt him againſt the pope and the Romans. With this propoſal Luitprand readily cloſed; and a league being concluded upon theſe terms between him and the exarch, the two armies joined, and began their march towards Spoleto. At their approach, the duke, deſpairing of being able to reſiſt two ſuch powers, came out with a ſmall attendance to meet them, and, throwing himſelf at the king's feet ſued, in that humble poſture, for pardon; which Luitprand not only granted him, but confirmed him in the dukedom, after he had obliged him to take a new oath of allegiance, and give hoſtages for his fidelity in time to come. From Spoleto, the two armies marched, in purſuance of the treaty, to Rome; and encamped in the meadows of Nero, between the Tiber and the Vatican.

19 The pope ſubmits to Luitprand.

Gregory had cauſed the city of Rome to be fortified in the beſt manner he could: but being ſenſible that the Romans alone could not long hold out againſt two ſuch armies, and reflecting on the kind treatment the duke of Spoleto had met with upon his ſubmitting to the king, he reſolved to follow his example; and accordingly, taking with him ſome of the clergy, and the principal inhabitants of the city, he went to wait on the king in his camp; and there, with a pathetic ſpeech, as he was a great maſter of eloquence, ſoftened Luitprand to ſuch a degree, that, throwing himſelf at his feet in the preſence of the whole army, he begged pardon for entering into an alliance againſt him;

Lombard. him: and, assuring him of his protection for the future, he went with him to the church of St Peter; and there, disarming himself in the presence of his chief officers, he laid his girdle, his sword, and his gantlet, with his royal mantle, his crown of gold, and cross of silver, on the apostle's sepulchre. After this, he reconciled the pope with the exarch, who was thereupon received into the city, where he continued for some time, maintaining a friendly correspondence with the pope. At this time an impostor, taking the name of *Tiberius*, and pretending to be descended from the emperors, seduced a great many people in Tuscany, and was by them proclaimed emperor. The exarch resolved to march against him; but as he had not sufficient forces to oppose the rebels, Gregory, who let no opportunity slip of obliging Leo, persuaded the Romans to attend the exarch in this expedition; by which means the usurper being taken in a castle, his head was sent to the emperor, and the rebellion utterly suppressed. But the emperor still insisting upon his edict against the images being received in Rome, the Romans, at the instigation of the pope, publicly renounced their allegiance to Leo, paid him no more tribute, and withdrew for ever their obedience to the emperors of the East.

20 The emperor seizes the dominions of the pope.

Leo, informed of this revolt, and not questioning but the pope was the author of it, immediately caused all the patrimonies of the church of Rome in Sicily, Calabria, and his other dominions, to be confiscated. At the same time, he ordered a powerful army to be raised, with a design to recover the towns that had revolted; to chastise the Romans for their rebellion; and, above all, to be revenged on the pope, who had raised all these disturbances, by opposing himself, and persuading others to oppose, the execution of his edict. Gregory, alarmed at the warlike preparations that were carrying on throughout the empire, and well apprised that they were chiefly designed against him and the Romans, resolved to recur to the protection of the French, the only nation at that time capable of coping with the emperor, and on whom, on account of their zeal for religion, he thought he might depend. The Lombards were then very powerful; but, as they wanted to be masters of Rome, he did not think it advisable to trust them. The Venetians, though zealous in the defence of the pope, were not yet in a condition to withstand the power of the emperor; and, besides, were jealous of the Lombards, who watched all opportunities of enlarging their dominions at the expence of their neighbours. As for Spain, it was then in a most deplorable condition, being over-run, and almost wholly ruined, by the Saracens.

21 Who applies to the French.

The French nation was at this time governed by the celebrated Charles Martel, who had distinguished himself in a most eminent manner in the wars of France and Germany; and had, not long before, gained a signal victory over the Saracens in the neighbourhood of Tours; whence he was generally reputed the best commander, and the greatest hero, of his time. To him, therefore, Gregory sent a solemn embassy, with a great number of relics, earnestly intreating him to take the Romans, and the church, under his protection, and defend them against the attempts of Leo. The ambassadors were received with extraordinary marks of honour; and a treaty was soon concluded between them and Charles, who engaged to march into Italy in person, at the head of a powerful army, in defence of the Romans and the church, if they should be attacked either by the emperor or the Lombards. On the other hand, the Romans were to acknowledge him for their protector, and confer on him the honour of the consulship, as it had been formerly conferred on Clovis by the emperor Anastasius, after that prince had defeated the Visigoths. The ambassadors returned from France loaded with rich presents. But Gregory did not long enjoy the fruit of their negociations; for he died the same year 731, and was succeeded by Gregory III. in whose time some place the above-mentioned embassy.

Lombards || Lomentaceæ.

22 End of the Lombard monarchy.

The French nation was at this time just recovered from its distressed situation under the descendants of Clovis; and by the bravery and conduct of Charles Martel, had become the most powerful kingdom in the west. His successor Pepin was no less wise and powerful than his father had been; and as the ambition of the Lombard princes would be satisfied with nothing less than the entire conquest of Italy, the French monarch, Charlemagne, under colour of assisting the pope, at last put an end to the empire of Lombardy, as related under the article FRANCE, n° 21, 22.

23 Character, &c. of the Lombards.

The Lombards were at first a cruel and barbarous nation; but divesting themselves by degrees of their native fierceness and barbarity, especially after they had embraced the Christian religion, they governed with such equity and moderation, that most other nations envied the happiness of those who lived under them. Under the government of the Lombards (says Paulus Diaconus) no violence was committed, no one unjustly dispossessed of his property, none oppressed with taxes; theft, robberies, murder, and adultery, were seldom heard of: every one went, without the least apprehension, wherever he pleased. Their laws were so just and equitable, that they were retained in Italy, and observed there some ages after their kingdom was at an end.—According to Paulus Diaconus, also, their dress was loose, and for the most part of linen, such as the Anglo-Saxons wore, being interwoven with various colours; that their shoes were open to the end of their foot, and that they used to button or lace them. From some ancient paintings, it appears, that they shaved the back part of their heads, but that their hair was long before; their locks being parted, and laid on each side their foreheads.

LOMBARD, or LOMBART (Peter), an engraver of considerable eminence, who flourished about the year 1660. He was a native of Paris, where he learned the art of engraving. It appears that he came into England before the revolution, because some of his plates for English publications are dated prior to that event. He executed a vast variety of plates, as well historical as emblematical; which, however, were chiefly for books. But his best works are portraits; and of these he produced a considerable number, which are esteemed. They are mostly after Vandyck.—He also engraved historical subjects, from Poussin, Raphael, Annibal Caracci, Guido, and other masters.

LOMENTACEÆ, in botany (from *lomentum*, a colour

Loch Lomond.

colour uſed by painters), the name of the 33d order in Linnæus's Fragments of a Natural Method, conſiſting of the following genera, many of which furniſh beautiful tinctures that are uſed in dyeing, *viz.* adenanthera, bauhinia, cæſalpina, caſſia, ceratonia, cercis, gleditſia, guilandina, hæmatoxylon, hymenæa, mimoſa, parkinſonia, poinciana, polygama. See BOTANY, p. 464.

LOCH-LOMOND, a large lake of Dunbarton or Lennox-ſhire in Scotland, of which Mr Pennant gives the following deſcription. "Loch-lomond, the laſt, the moſt beautiful of the Caledonian lakes. The firſt view of it from Tarbat preſents an extenſive ſerpentine winding amidſt lofty hills; on the north, barren, black, and rocky, which darken with their ſhade that contracted part of the water. On the weſt ſide, the mountains are cloathed near the bottoms with woods of oak quite to the water-edge; their ſummits lofty, naked, and craggy. On the eaſt ſide, the mountains are equally high; but the tops form a more even ridge parallel to the lake, except where Ben-lomond, like Saul amidſt his companions, overtops the reſt. The upper parts were black and barren; the lower had great marks of fertility, or at leaſt of induſtry, for the yellow corn was finely contraſted with the verdure of the groves intermixed with it.

"This eaſtern boundary is part of the Grampian hills, which extend from hence through the counties of Perth, Angus, Mearns, and Aberdeen. The road runs ſometimes through woods, at others is expoſed and naked; in ſome, ſo ſteep as to require the ſupport of a wall; the whole the work of the ſoldiery: bleſſed exchange of inſtruments of deſtruction for thoſe that give ſafety to the traveller, and a poliſh to the once inacceſſible native! Two great head-lands covered with trees ſeparate the firſt ſcene from one totally different; the laſt is called the *Point of Firkin*. On paſſing this cape an expanſe of water burſts at once on your eye, varied with all the ſofter beauties of nature. Immediately beneath is a flat covered with wood and corn: beyond, the headlands ſtretch far into the water, and conſiſt of gentle riſings; many have their ſurfaces covered with wood, others adorned with trees looſely ſcattered either over a fine verdure or the purple bloom of the heath. Numbers of iſlands are diſperſed over the lake, of the ſame elevated form as the little capes, and wooded in the ſame manner; others juſt peep above the ſurface, and are tufted with trees; and numbers are ſo diſpoſed as to form magnificent viſtos between.

"Oppoſite Luſs, at a ſmall diſtance from ſhore, is a mountainous iſle almoſt covered with wood; is near half a mile long, and has a moſt fine effect. I could not count the number of iſlands, but was told there are 28; the largeſt two miles long, and ſtocked with deer.

"The length of this charming lake is 24 Scotch miles; its greateſt breadth 8; its greateſt depth, which is between the point of Firkin and Ben-lomond, is 120 fathoms. Beſides the fiſh common to the lochs are guiniads, called here *poans*.

"The ſurface of Loch-lomond has for ſeveral years paſt been obſerved gradually to increaſe, and invade the adjacent ſhore: and there is reaſon to ſuppoſe that churches, houſes, and other buildings, have been loſt in the water. Near Luſs is a large heap of ſtones at a diſtance from the ſhore, known by the name of the old church; and about a mile to the ſouth of that, in the middle of a large bay, between Camſtraddan and the iſle Inch-lavanack, is another heap, ſaid to have been the ruins of a houſe. To confirm this, it is evident by a paſſage in Cambden's Atlas Britannica, that an iſland, exiſting in his time, is now loſt; for he ſpeaks of the iſle of Camſtraddan, placed between the lands of the ſame name and Inch-lavanack, in which, adds he, was an houſe and orchard. Beſides this proof, large trees with their branches ſtill adhering are frequently found in the mud near the ſhore, overwhelmed in former times by the increaſe of water. This is ſuppoſed to be occaſioned by the vaſt quantities of ſtone and gravel that are continually brought down by the mountain rivers, and by the falls of the banks of the Leven; the firſt filling the bed of the lake, the laſt impeding its diſcharge through the bed of the river."

Lomonozof.

LOMONOZOF, a celebrated Ruſſian poet, the great refiner of his native tongue, was the ſon of a perſon who trafficked in fiſh at Kolmogori: he was born in 1711, and was fortunately taught to read; a rare inſtance for a perſon of ſo low a ſtation in Ruſſia. His natural genius for poetry was firſt kindled by the peruſal of the Song of Solomon, done into verſe by Polotſki, whoſe rude compoſitions, perhaps ſcarcely ſuperior to our verſion of the pſalms by Sternhold and Hopkins, inſpired him with ſuch an irreſiſtible paſſion for the muſes, that he fled from his father, who was deſirous of compelling him to marry, and took refuge in the Kaikonoſpaſki monaſtery at Moſcow; there he had an opportunity of indulging his taſte for letters, and of ſtudying the Greek and Latin languages. In this ſeminary he made ſo conſiderable a progreſs in polite literature, as to be noticed and employed by the Imperial academy of ſciences. In 1736 he was ſent at the expence of that ſociety, to the univerſity of Marpurgh in Heſſe Caſſel, where he became a ſcholar of the celebrated Chriſtian Wolf, under whom he ſtudied univerſal grammar, rhetoric, and philoſophy. He continued at Marpurgh four years, during which time he applied himſelf with indefatigable diligence to chemiſtry, which he afterwards purſued with ſtill greater ſucceſs under the famous Henckel at Freyberg in Saxony. In 1741 he returned into Ruſſia; was choſen in 1742 adjunct to the imperial academy; and in the enſuing year member of that ſociety and profeſſor of chemiſtry. In 1760 he was appointed inſpector of the ſeminary, then annexed to the academy; in 1764 he was gratified by the preſent empreſs with the title of counſellor of ſtate; and died April 4th that year, in the 54th year of his age. Lomonozof excelled in various kinds of compoſition; but his chief merit, by which he bears the firſt rank among the Ruſſian writers, is derived from his poetical compoſitions, the fineſt of which are his odes. The firſt was written in 1739, while he ſtudied in Germany, upon the taking of Kotſchin, a fortreſs of Crim Tartary, by Marſhal Munich. The odes of Lomonozof are greatly admired for originality of invention, ſublimity of ſentiment, and energy of language; and compenſate for the turgid ſtyle which, in ſome inſtances, have been imputed to them, by that ſpirit and fire which are the prin-

Lomonozof, London.

principal characteriſtics in this ſpecies of compoſition. Pindar was his great model; and if we may give credit to a perſon well verſed in the Ruſſian tongue, he has ſucceeded in this daring attempt to imitate the Theban bard, without incurring the cenſure of Horace. In this, as well as ſeveral other ſpecies of compoſition, he enriched his native language with various kinds of metre, and ſeems to have merited the appellation beſtowed upon him of the *Father of Ruſſian Poetry*. A brief recapitulation of the principal works of Lomonozof, which were printed in three volumes octavo, will ſerve to ſhow the verſatility of his genius, and his extenſive knowledge in various branches of literature. The firſt volume, beſide a Preface on the advantages derived to the Ruſſian tongue from the eccleſiaſtical writings, contains ten ſacred and nineteen panegyric odes, and ſeveral occaſional pieces of poetry. The ſecond compriſes An Eſſay in Proſe on the Rules for Ruſſian Poetry; Tranſlation of a German Ode; Idylls; Tamira and Selim, a tragedy; Demophoon, a tragedy; Poetical Epiſtle on the Utility of Glaſs; two cantos of an epic poem, intitled, Peter the Great; A Congratulatory Copy of Verſes; An Ode; Tranſlation of Baptiſt Rouſſeau's Ode *Sur le Bonheur*; Heads of a Courſe of Lectures on Natural Philoſophy; certain paſſages tranſlated in verſe and proſe, according to the original, from Cicero, Eraſmus, Lucian, Ælian, Ammianus Marcellinus, Quintus Curtius, Homer, Virgil, Martial, Ovid, Horace, and Seneca, which Ruſſian tranſlations were brought as examples in his Lectures upon Rhetoric; laſtly, Deſcription of the Comet which appeared in 1744. The third volume conſiſts chiefly of Speeches and Treatiſes read before the Academy; Panegyric on the Empreſs Elizabeth; on Peter the Great; Treatiſe on the Advantages of Chemiſtry; on the Phenomena of the Air occaſioned by the Electrical Fire, with a Latin tranſlation of the ſame; on the Origin of Light as a new Theory of Colours; Methods to determine with preciſion the Courſe of a Veſſel; on the Origin of Metals by the means of Earthquakes; Latin Diſſertation on Solidity and Fluidity; on the Tranſit of Venus in 1761, with a German tranſlation. Beſide theſe various ſubjects, Lomonozof made no inconſiderable figure in hiſtory, having publiſhed two ſmall works relative to that of his own country. The firſt, ſtyled Annals of the Ruſſian Sovereigns, is a ſhort chronology of the Ruſſian monarchs; and the ſecond is, the Ancient Hiſtory of Ruſſia, from the Origin of that Nation to the Death of the Great Duke Yaroſlaf I. in 1054; a performance of great merit, as it illuſtrates the moſt difficult and obſcure period in the annals of this country.

LONDON, a large city of Middleſex in England, the metropolis of Great Britain, and one of the moſt wealthy and populous places in the world, is ſituated on the river Thames, in 51° 31′ north latitude, 400 miles ſouth of Edinburgh, and 270 ſouth-eaſt of Dublin; 180 miles weſt of Amſterdam, 210 north-weſt of Paris, 500 ſouth-weſt of Copenhagen, 600 north-weſt of Vienna, 790 ſouth-weſt of Stockholm, 800 north-eaſt of Madrid, 820 north-weſt of Rome, 850 north-eaſt of Liſbon, 1360 north-weſt of Conſtantinople, and 1414 ſouth-weſt of Moſcow.

2 Its different names.

This city was by the Romans firſt called *Londinium* or *Lundinum*, as we find it in Tacitus, Ptolemy, Antoninus, and Ammianus. That name was afterwards changed into *Auguſta*; in honour, as ſome ſay, of Helena Auguſta, the mother of Conſtantine the Great; while others think it more probable that it had this name from the ſecond legion, whoſe peculiar title was *Auguſta*; and ſome imagine that the honourable appellation of *Auguſta* was conferred upon this city by the Romans, as upon other principal cities of their empire, on account of its being grown up to be the capital of their Britiſh province. How long the name of *Auguſta* prevailed, is not now certainly known; but after the eſtabliſhment of the Saxons we find no more mention of Auguſta. It was then called *Caer Lundain*, *Lundoun Byrig*, *Lunden Ceaſter*, *Lunden-wye*, *Lundenne*, *Lunden-berh*, or *Lundenburg*; ſince the conqueſt the records call it *Londinia*, *Lundonia*, *Londine*, *Londres*; and, for ſeveral ages paſt, it has been called *London*, a manifeſt corruption from Tacitus's *Londinium*. The moſt probable derivation of theſe names appears to be, either from the Britiſh words *lhong* "a ſhip," and *din* "a town," *i. e.* a town or harbour for ſhips; or from *Llin* "a lake," *i. e. Llin din*, "the town upon the lake," the Surry ſide being ſuppoſed, upon very probable grounds, to have been anciently a great expanſe of water. London.

2 When founded.

Londinium, however, was not the primitive name of this famous place, which exiſted before the invaſion of the Romans; being, at the time of Cæſar's arrival in the iſland, the capital of the *Trinobantes* or *Trinouantes*. The name of this nation, as appears from Baxter's Britiſh Gloſſary†, was derived from the three following Britiſh words, *tri*, *nou*, *hant*, which ſignify the "inhabitants of the new city." This name, it is ſuppoſed, might have been given them by their neighbours, on account of their having newly come from the continent into Britain, and having there founded a city called *tri-now*, or the "new city;" the moſt ancient name of the renowned metropolis of Britain. The Trinobantes had come ſo lately from Belgium, that they ſeem ſcarcely to have been firmly eſtabliſhed in Britain at the time of the firſt Roman invaſion: For their new city, which ſoon after became ſo famous, was then ſo inconſiderable, that it is not mentioned by Cæſar, tho' he muſt have been within ſight of the place where it was ſituated. His ſilence about this place, indeed, is brought as a proof that he did not croſs the Thames; while Norden by the *firmiſſima civilas* of the Trinobantes underſtands the city in queſtion the Trinobantes themſelves having been among the firſt of the Britiſh ſtates who ſubmitted to that conqueror.

† p. 230.

Henry's Hiſt. vol. i. p. 170.

By Ptolemy, and ſome other ancient writers of good authority, indeed, Londinium is placed in Cantium, or Cent, on the ſouth ſide of the Thames; and it is the opinion of ſome moderns, that the Romans probably had a ſtation there, to ſecure their conqueſts on that ſide of the river, before they reduced the Trinobantes. The place fixed upon for this ſtation is St George's fields, a large plat of ground ſituated between Lambeth and Southwark, where many Roman coins, bricks, and checquered pavements, have been found. Three Roman ways from Kent, Surry, and Middleſex, interſected each other in this place: this therefore is ſuppoſed to be the original Londinum, which it is thought became neglected after the Romans reduced the Trinobantes, and ſettled on the other

London. side of the Thames; and the name was transferred to the new city.

The situation of this city, as Mr Pennant obſerves, was juſt ſuch as the people would ſelect according to the rule eſtabliſhed among the Britons. An immenſe foreſt originally extended to the river-ſide, and even as late as the reign of Henry II. covered the northern neighbourhood of the city, and was filled with various ſpecies of beaſts of chace. It was defended naturally by foſſes; one formed by the creek which run along Fleet-ditch, the other afterwards known by that of Walbrook; the ſouth ſide was guarded by the Thames; the north they might think ſufficiently protected by the adjacent foreſt.

3 When taken poſſeſſion of by the Romans.

The Romans poſſeſſed themſelves of London, on their ſecond invaſion in the reign of Claudius, about 105 years after their firſt under Cæſar. They had begun with Camalodunum, the preſent Maldon in Eſſex; and having taken it, planted there a colony conſiſting of veterans of the 14th legion. London and Verulam were next taken poſſeſſion of about one and the ſame time. Camalodunum was made a *colonia*, or place governed entirely by Roman laws and cuſtoms; Verulam (on the ſite of which St Alban's now ſtands), a *municipium*, in which the natives were honoured with the privileges of Roman citizens, and enjoyed their own laws and conſtitutions; and Londinium only a *præfectura*, the inhabitants, a mixture of Romans and Britons, being ſuffered to enjoy no more than the name of citizens of Rome, being governed by Præfects ſent annually from thence, without having either their own laws or magiſtrates. "It was even then of ſuch concourſe (ſays Mr Pennant), and ſuch vaſt trade, that the wiſe conquerors did not think fit to truſt the inhabitants with the ſame privileges as other places of which they had leſs reaſon to be jealous." But others obſerve, that this is a miſtake; and that the Romans, in order to ſecure their conqueſt, and to gain the affections of thoſe Britons who had already ſubmitted to their authority, made London equally a municipium or free city with Verulamium, as may be ſeen by referring to Aulus Gellius, l. 16. c. 13. and to Spanhem. orbis Roman. p. 37, 38. tom. ii.

4 Ancient commerce of London.

It is difficult to ſay what were the particular articles of commerce exported from and imported into the port of London at this period. The imports and exports of the iſland in general we know: Strabo ſays, "Britain produceth corn, cattle, gold, ſilver, iron; beſides which, ſkins, ſlaves, and dogs naturally excellent hunters, are exported from that iſland." It is probable that the two firſt and three laſt articles were exported from London; and perhaps, too, the *gagates* or jet-ſtone mentioned by Solinus as one of the productions of Britain, together with horſes, were exported from thence. The imports were at firſt ſalt, earthen ware, and works in braſs, poliſhed bits of bones emulating ivory, horſe-collars, toys of amber, glaſſes, and other articles of the ſame material.

In the reign of Nero, as Tacitus informs us, London was become a city highly famous for the great conflux of merchants, her extenſive commerce, and plenty of all things. No fewer than ſeven of the fourteen itinera of Antoninus begin or end at London; which tends to corroborate the many proofs which might be adduced, that this city was the capital of Britain in the Roman times. London

5 When firſt ſurrounded with walls.

At firſt London had no walls or other fortifications to defend it, and was therefore expoſed to the attacks of every enemy; and thus it ſuffered ſeverely about the year 64, being burnt by the Britons under Boadicea, and all the inhabitants maſſacred. But it was ſoon reſtored by the Romans; and increaſed ſo much, that in the reign of the emperor Severus it is called by Herodian *a great and wealthy city*. It continued, however, in a defenceleſs ſtate for more than a century after this laſt period; when at laſt a wall of hewn ſtone and Britiſh bricks was erected round it.

London at this time extended in length from Ludgate-hill to a ſpot a little beyond the Tower. The breadth was not half equal to the length, and at each end grew conſiderably narrower. Maitland aſcribes the building of the walls to Theodoſius governor of Britain in 369. Dr Woodward, with more probability, ſuppoſes them to have been founded under the auſpices of Conſtantine the Great; and this ſeems to be confirmed by the numbers of coins of that emperor's mother Helena, which have been diſcovered under them, placed there by him in compliment to her. The ſame emperor made it a biſhop's ſee; for it appears that the biſhops of London and York, and another Engliſh biſhop, were at the council of Ailes in the year 314: he alſo ſettled a mint in it, as is plain from ſome of his coins. The ancient courſe of the wall was as follows: It began with a fort near the preſent ſite of the Tower, was continued along the Minories, and the back of Houndſditch, acroſs Biſhopſgate-ſtreet, in a ſtraight line by London-wall to Cripplegate; then returned ſouthward by Crowder's Well Alley, (where ſeveral remnants of lofty towers were lately to be ſeen) to Alderſgate; thence along the back of Bull and Mouth-ſtreet to Newgate, and again along the back of the houſes in the Old Bailey to Ludgate; ſoon after which it probably finiſhed with another fort, where the houſe, late the king's printing houſe, in Black Friars, now ſtands: from hence another wall ran near the river ſide, along Thames-ſtreet, quite to the fort on the eaſtern extremity. The walls were three miles a hundred and ſixty-five feet in circumference, guarded at proper diſtances on the land ſide with fifteen lofty towers; ſome of them were remaining within theſe few years, and poſſibly may ſtill. Maitland mentions one twenty-ſix feet high, near Gravel-lane, on the weſt ſide of Houndſditch; another, about eighty paces ſouth-eaſt towards Aldgate; and the baſes of another, ſupporting a modern houſe, at the lower end of the ſtreet called the Vinegaryard, ſouth of Aldgate. The walls, when perfect, are ſuppoſed to have been twenty-two feet high, the towers forty. Theſe, with the remnants of the wall, proved the Roman ſtructure, by the tiles and diſpoſition of the maſonry. London-wall, near Moorfields, is now the moſt entire part left of that ancient precinct. The gates, which received the great military roads, were four. The Prætorian way, the Saxon Watling ſtreet, paſſed under one, on the ſite of the late Newgate; veſtiges having been diſcovered of the road in digging above Holburn-bridge: it turned down to Dowgate, or more properly Dwr-gate or Water-gate, where

6 Their ancient courſe, &c.

London. there was a trajectus or ferry, to join it to the Watling-ſtreet, which was continued to Dover. The Hermin ſtreet paſſed under Cripplegate; and a vicinal way went under Aldgate by Bethnal-green, towards Oldford, a paſs over the river Lee to Duroleiton, the modern Leiton in Eſſex.

7 London ſubmits to the Saxons. After the Romans deſerted Britain, a new and fierce race ſucceeded. The Saxons, under their leaders Hengiſt and Horſa, landed in 448, having been invited over by the provincials as auxiliaries againſt the Scots and Picts; but quarrelling with their friends, they found means to eſtabliſh themſelves in the iſland, and in proceſs of time entirely ſubdued them, as related under the article ENGLAND, n° 31—44. London fell into the hands of thoſe invaders about the year 457; and became the chief city of the Saxon kingdom in Eſſex. It ſuffered much in the wars carried on between the Britons and Saxons: but it ſoon recovered; ſo that Bede calls it a *princely mart-town*, under the government of a chief magiſtrate, whoſe title of *portgrave*, or *portreve* (for we find him called by both names), conveys a grand idea of the mercantile ſtate of London in thoſe early ages, that required a governor or guardian of the port. During the civil wars of the Saxons with each other, the Londoners had always the addreſs to keep themſelves neuter; and about the year 819, when all the ſeven Saxon kingdoms fell under the power of Egbert, London became the metropolis of England, which it has ever ſince continued.

8 Plundered by the Danes. During the invaſions of the Danes, London ſuffered greatly. In 849, theſe invaders entered the Thames with 250 ſhips, plundered and burnt the city, and maſſacred the inhabitants; and two years after they returned with a fleet of 350 ſail, fully determined to deſtroy every thing that had eſcaped their barbarity in the former expedition. At this time, however, they were diſappointed; moſt of their troops being cut in pieces by king Ethelwolf and his ſon Athelbald; yet ſuch was the deſtruction made by thoſe barbarians at London, that it ſuffered more from theſe two incurſions than ever it had done before.

9 Recovers under Alfred the Great. In the reign of king Alfred the Great, London began to recover from its former ruinous ſtate. He rebuilt its walls, drove out the Daniſh inhabitants who had ſettled there, reſtored the city to its former liberties and beauty, and committed the care of it to his ſon-in-law, Elthelred duke of Mercia, in hopes that this might always be a place of ſecure retreat within its ſtrong walls, whatever might happen from a foreign or domeſtic enemy. In 893, however, he had the mortification to ſee his capital totally reduced to aſhes by an accidental fire, which could not be extinguiſhed, as the houſes at that time were all built of wood. The walls, however, being conſtructed of incombuſtible materials, continued to afford the ſame protection as before; the houſes were quickly rebuilt, and the city divided into wards and precincts for its better order and government. This king alſo inſtituted the office of ſheriff, the nature of which office made it neceſſary to have it alſo in London: ſo that here we have the glimmerings of the order of magiſtrates afterwards ſettled in the city of London; in the perſon of the portreve, or portgrave, or governor of the city, as ſupreme magiſtrate; in the ſheriff, and in the officer or ſubordinate magiſtrate by what name ſoever then diſtinguiſhed, which, being placed at the head of each ward or precinct, were analogous to the more modern title of *aldermen* and *common-council men*. London.

10 Reduced to aſhes.

11 Its government ſettled.

12 Brick and ſtone houſes firſt erected. Alfred having ſettled the affairs of England in the moſt prudent manner, directed his attention to the ornamenting, as much as poſſible, the city of London. For this purpoſe, he ſpirited up the Engliſh to an emulation in building their houſes of ſtronger and more durable materials than formerly. At that time their houſes were moſtly of wood; and an houſe built of any other materials was looked upon as a kind of wonder. But Alfred having begun to raiſe his palaces of ſtone and brick, the opulent Londoners, and the nobility reſident in and about London, followed the example, though the cuſtom did not come into general uſe till ſome ages after.

13 Beſieged by Canute. In 1015, a foreign enemy again appeared before London. Canute king of Denmark having invaded and plundered the counties of Dorſet, Somerſet, and Wilts, ſailed up the Thames with 200 ſhips, and laid ſiege to the city. The citizens continued faithful, notwithſtanding the defection of the greateſt part of the kingdom; and made ſuch a brave reſiſtance, that Canute thought fit to withdraw his army, leaving only his fleet to blockade the city by water, that when he found a fair opportunity he might renew the ſiege with better ſucceſs. At laſt, however, being defeated in ſeveral battles by Edmund Ironſide, he was obliged to call off his ſhips to cover his own army in caſe of neceſſity. In the compromiſe, however, which was afterwards made between Edmund and Canute, the city of London was given to the latter, and owned him for its lawful ſovereign. We have a ſtrong proof of the opulence of London even at this time, from the tax laid upon it by Canute in order to pay his army; this being no leſs than 10,500 l. while the reſt of the nation was at the ſame time taxed only at 72,000 l.

14 Sends repreſentatives to parliament. In 1046, we have the firſt inſtance of the Londoners ſending repreſentatives to parliament. This happened on ſettling the ſucceſſion to the throne after Canute's death. The Engliſh in general declared for Edward ſon of king Ethelred; or, if that could not be carried, for Hardicanute, ſon of Canute by queen Emma, and then abſent on a tour to Denmark. The city of London eſpouſed the claim and intereſt of Harold Harefoot, ſon alſo of Canute, by queen Elgiva of Northampton. Edward's party ſoon declined; and the Londoners agreed, for the peace of the realm, that the two brothers ſhould divide the kingdom between them; but as Hardicanute did not return in proper time to Enlgand, a *wittenage-mote* was held at Oxford, where earl Leofric, and moſt of the thanes on the north of the Thames, with the pilots of London, choſe Harold for their king. Here, by *pilots* we are to underſtand the directors, magiſtrates, or leading men of the city: and this manifeſtly ſhows, that London was then of ſuch conſequence, that no important national affair was tranſacted without the conſent of the inhabitants; for the Saxon annals aſſure us, that none were admitted into this aſſembly of election but the nobility and the pilots of London.

15 Suffers greatly by fires, hurricanes, &c. On the invaſion of the Normans under William I. London ſubmitted as well as the reſt of the kingdom; and received two charters from that prince, confirming

London. ing all the privileges they had under the Saxon kings, and adding ſeveral new ones. But while the citizens were promiſing themſelves all manner of ſecurity and tranquillity under the new government, it was almoſt entirely reduced to aſhes by an accidental fire in 1077. It had ſcarcely recovered from this calamity, when it was viſited by another of the ſame kind in 1086, which began at Ludgate, and deſtroyed the beſt and moſt opulent part of the city; conſuming, among other buildings, the cathedral of St Paul's; which, however, was ſoon rebuilt more magnificently than before. Under the reign of William Rufus, London ſuffered conſiderably by fires, hurricanes, and inundations, and ſeems to have been depreſſed by the tyranny of that prince; but Henry I. granted large immunities to the city, which again revived its trade, and was favourable to the progreſs of the arts. The king, however, ſtill retained the privilege of appointing the portreve, or chief magiſtrate; but the immunities granted to the Londoners ſecured their affections, and tended much to ſecure him on the throne. At the ſame time, there was ſuch a plenty of all kinds of proviſions, that as much corn was ſold for 1s. as would ſuffice 100 people for a day; 4d. would purchaſe as much hay and corn as would maintain 20 horſes for a day; and a ſheep could be bought for a groat.

16 Monſtrous licentiouſneſs of the Normans.

Henry thought proper alſo to check the licentious behaviour of the Normans, which, by the favour ſhowed them under the two Williams, had carried them into the moſt barbarous practices. Thoſe who followed William Rufus in his excurſions, haraſſed and plundered the country at diſcretion. Many of them were ſo extravagant in their barbarity, that what they could not eat or drink in their quarters, they either obliged the people to carry to market and ſell for their uſe, or elſe they would throw it into the fire: and, at their going off, they frequently waſhed their horſes heels with the drink, and ſtaved the caſks containing the remainder. King Henry reſolved to put a ſtop to theſe exceſſes and ſavage cuſtoms; and therefore publiſhed a proclamation at London, commanding that thenceforward all perſons who ſhould be convicted of ſuch barbarities ſhould have their eyes pulled out, or their hands or feet cut off, as the miniſters of juſtice ſhould think fit. This effectually checked the inſolence of the Normans, and the city continued to flouriſh throughout the reigns of Henry I. and Stephen. The attachment of the citizens to Stephen, however, was a crime which never could be forgiven by Henry II. and, of conſequence, he made them ſenſible of his diſpleaſure, by making frequent demands of money from them.

17 Of the Londoners.

About this time, indeed, the Londoners were arrived at ſuch a pitch of licentiouſneſs, that their proſperity ſeemed a curſe rather than a bleſſing. The ſons of the moſt eminent and wealthy citizens entered into a confederacy to commit burglaries, and to rob and murder all that came in their way in the nighttime. The king took an opportunity from theſe irregularities to enrich himſelf. He demanded ſeveral loans and free gifts; till at laſt the Londoners, to prevent further inquiries into their conduct, paid into the exchequer 5000l. in three years. Theſe diſorders, however, were at laſt ſtopped by the execution of John Senex; who, though a very rich and reputable citizen, had engaged in theſe enterprizes. He offered 500 lb. weight of ſilver, a prodigious ſum in thoſe days, for his pardon, but was refuſed. The king, however, ſtill continued to drain the citizens of their money by free gifts; and at laſt fined every ſeparate guild, fraternity, or company, that had preſumed to act as bodies corporate without the royal letters-patent. London.

On the death of Henry II. the title of the firſt magiſtrate of London was changed from *portgreve* to that of *bailiff*; and in 1189 claimed and acted in the office of the *chief butler* at the coronation of Richard I. In 1191 this monarch permitted the bailiff, named *Henry Fitz Alwine*, to aſſume the title of *mayor*. For, in 1192, we find certain orders of the mayor and aldermen to prevent fires; whereby it was ordained, that "all houſes thereafter to be erected in London and the liberties thereof, ſhould be built of ſtone, with party-walls of the ſame; and covered either with ſlates or tiles, to prevent thoſe dreadful calamities by fire, which were frequently and chiefly occaſioned by houſes built of wood, and thatched with ſtraw or reeds." And for this purpoſe, it was alſo provided by the diſcreeter men of the city, "that 12 aldermen of the city ſhould be choſen in full huſtings, and there ſworn to aſſiſt the mayor in appeaſing contentions that might ariſe among neighbours in the city upon incloſure betwixt land and land, and to regulate the dimenſions of party-walls, which were to be of ſtone, 16 feet high and three feet thick; and to give directions about girders, windows, gutters, and wells." Such confidence alſo did Richard put in the wiſdom and faithfulneſs of the city of London, that when it was reſolved to fix a ſtandard for weights and meaſures for the whole realm, his majeſty committed the execution thereof to the ſheriffs of London and Middleſex, whom he commanded to provide meaſures, gallons, iron rods, and weights for ſtandards, to be ſent to the ſeveral counties of England. This happened in 1198, at which time corn was advanced to the enormous price of 18s. 4d. per quarter.

18 The office of mayor, when firſt inſtituted.

19 Favours granted to the city by King John.

The city of London was much favoured by King John, who granted them three charters ſoon after his acceſſion. The firſt was a recital and confirmation of thoſe granted by Henry I. and II. with the farther privilege of being free from toll and every other duty or cuſtom in his majeſty's foreign dominions; for which they paid the ſum of 3000 merks. The ſecond was a confirmation of one granted by King Richard. By this the citizens of London had the juriſdiction and conſervancy of the river Thames; with a clauſe to extend that juriſdiction, and the powers therewith granted, to the river Medway; and with another clauſe to enable the ſaid city, as conſervators of the rivers Thames and Medway, to inflict a penalty of 10l. upon any perſon that ſhould preſume to erect a wear in either of theſe rivers. The third charter contains a fee-farm-rent of the ſheriffwicks of London and Middleſex at the ancient rent, of which they had been deprived by Queen Maud; granting them alſo the additional power of chooſing their own ſheriffs. This charter was given by way of conveyance from the crown to the citizens for a valuable conſideration, by which the ſheriffwick became their freehold; and this is the firſt covenant or conveyance we find on record

London. with the legal terms of *to have and to hold*, which are at this time accounted an essential part in all conveyances of property.

20 London oppressed by Henry III. During the reign of Henry III. the city of London was oppressed in many different ways. In 1218, he exacted a fine of 40 marks for selling a sort of cloth not two yards within the lists; and a 15th of the citizens personal estates for the enjoyment of their ancient rights and privileges. In 1221, he commanded by proclamation all the foreign merchants to depart the city; which drew 30 marks from the Anseatic company of the *Steelyard*, to have seisin of their guild or hall in Thames-street. But it was the wrestling-match at St Giles's in the fields that brought on their greatest burden. In the year 1221, on St James's day, the citizens of London having carried off the victory from the people of Westminster and other neighbouring villages, the steward of the abbot of Westminster, meditating revenge against the Londoners, proposed another wrestling-match with them, and gave a ram for the prize. The citizens resorted to the place at the time appointed; but were unexpectedly assaulted by a great number of armed men, who killed and wounded many, and dispersed the rest. This raised a great commotion in the city. The populace breathed revenge; and, by the instigation of Constantine Fitz-Arnulph, a great favourer of the French party during the troubles in king John's reign, they proceeded to Westminster, and pulled down the houses both of the steward and abbot. Hearing afterwards that the abbot was come into the city with his complaint to Philip Daubney the king's counsel, they pursued him, beat his servants cruelly, took away 12 of his horses, and would have murdered himself, had he not escaped by a back-door. Upon this tumult, Hubert de Bury, then chief justiciary, summoned the mayor and many of the principal citizens to attend him in the tower of London; and inquiring for the authors of the riot, Constantine, the ringleader, boldly answered, that "he was one; that they had done no more than they ought; and that they were resolved to avow what they had done, let the consequence be what it would." In this he was seconded by his nephew and one Geoffery; but the justiciary, having dismissed all the rest, detained these three, and ordered them to be hanged next morning, though Constantine offered 15,000 marks for his pardon. Hubert then coming into the city with a strong guard, caused the hands and feet of most of the principal rioters he could seize to be cut off: all which was executed without any legal proceedings or form of trial. After these arbitrary cruelties, he degraded the mayor and all the magistrates; placed a *custos* over the city, and obliged 30 persons of his own choosing to become securities for the good behaviour of the whole city. Several thousand marks were also exacted by the king, before he would consent to a reconciliation.

This arbitrary behaviour alarmed the whole nation. The parliament of 1224 began to be uneasy for themselves, and addressed his majesty that he would be pleased to confirm the charter of liberties which he had sworn to observe; and the consequence of this application was a confirmation of the magna charta in the full parliament at Westminster in the year 1225. At this time also, the rights and privileges of the citizens were confirmed. They were exempted from prosecutions for burels, *i. e.* listed cloth; and were granted the right of having a common seal. The necessitous circumstances of this monarch, however, made him often exact money arbitrarily as long as he lived. London.

Under the succeeding reigns, as the liberty of the people in general was augmented, so the liberty, opulence, and power of the citizens of London increased, until they became a kind of balance to the power of the crown itself, which in some measure they still continue to be. Riots indeed, for which they generally suffered, were by no means unfrequent; the city often suffered by fires and plagues. Nothing, however, happened which materially affected the welfare of the city, till the reign of Charles II. in 1665.—This year London was ravaged by the most violent plague ever known in Britain. The whole summer had been remarkably still and warm, so that the weather was sometimes suffocating even to people in perfect health; and by this unusual heat and sultry atmosphere, people were undoubtedly prepared for receiving the infection, which appeared with violence in the months of July, August, and September. A violent plague had raged in Holland in the year 1663; on which account the importation of merchandise from that country was prohibited by the British legislature in 1664. Notwithstanding this prohibition, however, it seems the plague had actually been imported; for in the close of the year 1664, two or three persons died suddenly in Westminster, with marks of the plague on their bodies. Some of their neighbours, terrified at the thoughts of their danger, removed into the city; but their removal proved too late for themselves, and fatal to those among whom they came to reside. They soon died of the plague; and communicated the infection to so many others, that it became impossible to extinguish the seeds of it by separating those that were infected from such as were not. It was confined, however, through a hard frosty winter, till the middle of February, when it again appeared in the parish of St Giles's, to which it had been originally brought; and after another long rest till April, showed its malignant force afresh, as soon as the warmth of the spring gave it opportunity. —At first, it took off one here and there, without any certain proof of their having infected each other, and houses began to be shut up, with a design to prevent its spreading. But it was now too late; the infection gained ground every day, and the shutting up of houses only made the diseases spread wider. People, afraid of being shut up, and sequestered from all communications with society, concealed their illness, or found means to escape from their places of confinement; while numbers expired in the greatest torments, destitute of every assistance; and many died both of the plague and other diseases, who would in all probability have recovered, had they been allowed their liberty, with proper exercise and air.—A house was shut up on account of a maid-servant, who had only spots, and not the gangrenous plague-blotches, upon her, so that her distemper was probably a petechial fever. She recovered; but the people of the house obtained no liberty to stir, either for air or exercise, for 40 days. The bad air, fear, anger, and vexation, attending this injurious treatment, cast the mistress of the family into a fever. The visitors appointed to search 21 Dreadful plague in 1665.

London. search the houſes, ſaid it was the plague, though the phyſicians were of a different opinion: the family, however, were obliged to begin their quarantine anew, though it had been almoſt expired before; and this ſecond confinement affected them ſo much, that moſt of the family fell ſick, ſome of one diſtemper and ſome of another. Every illneſs that appeared in the family produced a freſh prolongation of their confinement; till at laſt the plague was actually brought in by ſome of thoſe who came to inquire into the health of the family, and almoſt every perſon in the houſe died.—Many examples of a ſimilar kind happened, and this was one of the worſt conſequences of ſhutting up houſes. All means of putting a ſtop to the infection were evidently ineffectual. Multitudes fled into the country; many merchants, owners of ſhips, &c. ſhut themſelves up, on board their veſſels, being ſupplied with proviſions from Greenwich, Woolwich, and ſingle farm-houſes on the Kentiſh ſide. Here, however, they were ſafe; for the infection never reached below Debtford, though the people went frequently on ſhore to the country-towns, villages, and farm-houſes, to buy freſh proviſions. As the violence of the plague increaſed, the ſhips which had families on board removed farther off; ſome went quite out to ſea, and then put into ſuch harbours and roads as they could beſt get at.

In the mean time, the diſtemper made the moſt rapid advances within the city. In the laſt week of July, the number of burials amounted to 2010; but the firſt week of Auguſt it roſe to 3817; thence to 3880; then to 4237; the next week, to 6102; and at laſt to 7000 and 8000 weekly. In the laſt week of Septemper, however, the fury of the diſeaſe began to abate; though vaſt numbers were ſick, yet the number of burials decreaſed from 7155 to 5538; the next week there was a farther decreaſe to 4929, then to 4327, next to 2665, then to 1421, and the next week to 1031.

All this while, the poor people had been reduced to the greateſt diſtreſſes, by reaſon of the ſtagnation of trade, and the ſickneſſes to which they were peculiarly liable on account of their manner of living. The rich, however, contributed to their ſubſiſtence in a moſt liberal manner. The ſums collected on this occaſion, are indeed almoſt incredible; being ſaid to amount to 100,000 l. per week. The king is reported to have contributed 1000l. weekly; and in the pariſh of Cripplegate alone 17,000 l. was diſtributed weekly among the poor inhabitants.—By the vigilance alſo of the magiſtrates, proviſions continued remarkably cheap throughout the whole time of this dreadful calamity, ſo that all riots and tumults on that account were prevented; and at laſt, on the ceſſation of the diſeaſe in the winter of 1665, the inhabitants who had fled returned to their habitations, and London to appearance become as populous as ever, though it was computed that 100,000 perſons had been carried off by the plague.

22 Account of the great fire in 1666. The city was ſcarcely recovered from the deſolation occaſioned by the plague, when it was almoſt totally laid in aſhes by a moſt dreadful fire. This broke out in a baker's ſhop in Pudding-lane, on Saturday-night, September 2. 1666. In a few hours Billingſgate ward was entirely burnt down; and before morning the fire had croſſed Thames-ſtreet, and deſtroyed the church of St Magnus. From thence it proceeded to the bridge, London. and conſumed a great pile of buildings there; but was ſtopped by the want of any thing more to deſtroy. The flames, however, being ſcattered by a ſtrong eaſt wind, continued their devaſtations in other quarters. All efforts to ſtop it proved unſucceſsful throughout the Sunday. That day it proceeded up as far as Garlick-hithe; and deſtroying Canon-ſtreet, invaded Cornhill and the exchange. On Monday, the flames having proceeded eaſtward againſt the wind through Thames-ſtreet, invaded Tower-ſtreet, Grace-church-ſtreet, Fenchurch-ſtreet, Dowgate, Old-fiſh-ſtreet, Watling-ſtreet, Thread-needle-ſtreet, and ſeveral others, from all which it broke at once into Cheapſide. In a few hours Cheapſide was all in flames, the fire having reached it from ſo many places at once. The fire then continuing its courſe from the river on one ſide, and from Cheapſide on the other, ſurrounded the cathedral of St Paul's. This building ſtood by itſelf at ſome diſtance from any houſes; yet ſuch was the violence of the flames, and the heat of the atmoſphere occaſioned by them, that the cathedral took fire at top. The great beams and maſſy ſtones broke through into Faith-church underneath, which was quickly ſet on fire; after which, the flames invaded Pater-noſter-row, Newgate-ſtreet, the Old Bailey, Ludgate-hill, Fleet-ſtreet, Iron-monger-lane, Old-Jury, Laurence-lane, Milk-ſtreet, Wood-ſtreet, Gutter-lane, Foſter-lane, Lothbury, Cateaton-ſtreet; and, having deſtroyed Chriſt-church, burnt furiouſly through St Martin's Le Grand towards Alderſgate.

The fire had now attained its greateſt extent, and was ſeveral miles in compaſs. The vaſt clouds of ſmoke obſcured the ſun ſo, that he either could not be ſeen at all, or appeared through it as red as blood. The flames reached an immenſe way up into the air, and their reflection from the ſmoke, which in the night-time ſeemed alſo like flame, made the appearance ſtill more terrible. The atmoſphere was illuminated to a great extent, and this illumination is ſaid to have been viſible as far as Jedburgh in Scotland. Some of the light aſhes alſo are ſaid to have been carried to the diſtance of 16 miles. Guildhall exhibited a ſingular apperance. The oak with which it was built was ſo ſolid that it would not flame, but burnt like charcoal, ſo that the building appeared for ſeveral hours like an enchanted palace of gold or burniſhed braſs.

At laſt, on Wedneſday morning, when every one expected that the ſuburbs as well as the city were to have been burnt, the fire began of itſelf to abate by reaſon of the wind having ceaſed, and ſome other changes no doubt taken place in the atmoſphere. It was checked by the great building in Leaden-hall-ſtreet, and in other ſtreets by the blowing up ſeveral houſes with gun-powder; and on Thurſday the flames were quite extinguiſhed.—The following is a calculation of the damage done by this extraordinary conflagration.

23 Calculation of the damage done

	L.	*s.*	*d.*
Thirteen thouſand two hundred houſes, at 12 years purchaſe, ſuppoſing the rent of each 25l. Sterling, - - -	3,960,000	0	0
Eighty-ſeven pariſh-churches, at 8000 l. - - -	696,000	0	0
carrried forward	4,656,000	0	0

London.

brought over	L. 4,656,000	0	0
Six conſecrated chapels, at 2000l.	12,000	0	0
The royal exchange -	50,000	0	0
The cuſtom-houſe -	10,000	0	0
Fifty-two halls of companies, at 1500 l. each. - -	78,000	0	0
Three city-gates at 3000l. each	9000	0	0
Jail of Newgate - -	15,000	0	0
Four ſtone-bridges - -	6000	0	0
Seſſions-houſe - - -	7000	0	0
Guildhall, with the courts and offices belonging to it - -	40,000	0	0
Blackwell-hall - - -	3000	0	0
Bridewell - - - -	5000	0	0
Poultry Compter - -	5000	0	0
Woodſtreet Compter -	3000	0	0
St Paul's church - -	2,000,000	0	0
Wares, houſehold-ſtuff, money, and moveable-goods loſt or ſpoiled	2,000,000	0	0
Hire of porters, carts, waggons, barges, boats, &c. for removing goods - -	200,000	0	0
Printed books and paper in ſhops and warehouſes - -	150,000	0	0
Wine, tobacco, ſugar, &c. of which the town was at that time very full - - -	1,500,000	0	0
	10,689,000	0	0

It was never certainly known whether this fire was accidental or deſigned. A ſuſpicion fell upon the Papiſts; and this gained ſuch general credit, that it is aſſerted for a truth on the monument which is erected in memory of the conflagration. Of the truth of this aſſertion, however, though there was not ſufficient proof, it had the effect of making the Papiſts moſt violently ſuſpected and abhorred by the Proteſtants, which ſome time after proved very prejudicial to the city itſelf.

24 A deſign to ſet it on fire again.

From this calamity, great as it was, London ſoon recovered itſelf, and became much more magnificent than before; the ſtreets, which were formerly crooked and narrow, being now built wide and ſpacious; and the induſtry of its inhabitants repaired the loſſes they had ſuſtained. In 1679, the city was again alarmed by the diſcovery of a deſign to deſtroy it by fire a ſecond time. Elizabeth Oxly, ſervant to one Rind in Fetter-lane, having ſet her maſter's houſe on fire, was apprehended on ſuſpicion, and confeſſed, that ſhe had been hired to do it by one Stubbs a Papiſt, for a reward of 5 l. Stubbs being taken into cuſtody, acknowledged that he had perſuaded her to it; and that he himſelf had been prevailed upon by one father Gifford his confeſſor, who had aſſured him, that by burning the houſes of heretics he would do a great ſervice to the church. He alſo owned that he had ſeveral conferences with Gifford and two Iriſhmen on the affair. The maid and Stubbs alſo agreed in declaring, that the Papiſts intended to riſe in London, expecting to be powerfully ſupported by a French army. In conſequence of this diſcovery, the Papiſts were baniſhed from the city and ten miles round, and five Jeſuits were hanged for the abovementioned plot.

The Papiſts thought to revenge themſelves, by forging what was called the *meal-tub plot*, in which the Preſbyterians were ſuppoſed to hatch treacherous deſigns againſt the life of the king. Sir Edmondbury Godfrey alſo, who had been very active in his proceedings againſt the Papiſts, was murdered by ſome unknown perſons; and this murder, together with their diſcovering the falſehood of the meal-tub plot, ſo exaſperated the Londoners, that they reſolved to ſhow their deteſtation of Popery, by an extraordinary exhibition on the 17th of November, Queen Elizabeth's acceſſion to the throne, on which day they had uſually burnt the pope in effigy. The proceſſion began with a perſon on horſeback perſonating Sir Edmondbury Godfrey, attended by a bell-man proclaiming his execrable murder. He was followed by a perſon carrying a large ſilver croſs, with prieſts in copes, Carmelites, and Gray-friars, followed by ſix Jeſuits: then proceeded divers waiters, and after them ſome biſhops with lawn-ſleeves, and others with copes and mitres. Six cardinals preceded the pope, enthroned in a ſtately pageant, attended by divers boys with pots of incenſe, and the devil whiſpering in his ear. In this order they marched from Biſhopſgate to Fleet-ſtreet; and there, amidſt a great multitude of ſpectators, committed his holineſs to the flames.

This proceſſion gave great offence to the court, at which the duke of York, afterwards James II. had a great influence. The breach was farther widened by the choice of ſheriffs for that year. The candidates ſet up by the court were rejected by a majority of almoſt two to one; but this did not deter their party from demanding a poll in their behalf, upon which a tumult enſued. This was repreſented by the Popiſh party in ſuch colours to the king, that he iſſued out a commiſſion that ſame evening for trying the rioters; which, however, was ſo far from intimidating the reſt, that they grew more and more determined, not only to oppoſe the Popiſh party, but to exclude the duke of York from his ſucceſſion to the crown.

In the mean time, the king prorogued the parliament, to prevent them from proceeding in their inquiry concerning the Popiſh plot, and the excluſion-bill. Upon this the lord-mayor, aldermen, and common-council, preſented a petition to his majeſty, in which they requeſted, that he would permit the parliament to ſit in order to complete their ſalutary meaſures and councils. This petition was highly reſented by the king; who, inſtead of granting it, diſſolved the parliament, and could never afterwards be reconciled to the city. From this time it was determined to ſeize their charter; and freſh provocations having been given about the election of ſheriffs, a *quo warranto* was at laſt produced by the attorney-general, in order to overthrow their charter, and thereby to deprive the citizens of the power to chooſe ſheriffs. This information ſet forth, That "the mayor and commonalty and citizens of the city of London, by the ſpace of a month then laſt paſt and more, uſed, and yet do claim to have and uſe, without any lawful warrant or regal grant, within the city of London aforeſaid, and the liberties and privileges of the ſame city, the liberties and privileges following, viz. 1. To be of themſelves a body corporate and politic, by the name of *mayor and commonalty and citizens of the city of London*. 2. To have ſheriffs *civitat. et com. London. & com. Middleſex*, and to name, make, and elect, and conſtitute

25 Which gives occaſion to a quarrel with the court.

26 A *Quo Warranto* granted againſt the city.

London. constitute them. 3. That the mayor and aldermen of the ſaid city ſhould be juſtices of the peace, and hold ſeſſions of the peace. All which liberties, privileges, and franchiſes, the ſaid mayor and commonalty, and citizens of London, upon the king did by the ſpace aforeſaid uſurp, and yet do uſurp."

Though nothing could be more unjuſt than this proſecution, the miniſtry were determined at all events to cruſh the Londoners; rightly judging, that it would be an eaſy matter to make all other corporations ſurrender their charters into the king's hands, and that they had no other body in the nation to fear. Accordingly they diſplaced ſuch judges as would not approve of their proceedings; and, on the 12th of June 1683, Juſtice Jones pronounced the following ſentence: "That a city might forfeit its charter; that the malverſations of the common-council were acts of the whole city; and that the points ſet forth in the pleadings were juſt grounds for the forfeiting of a charter."

Notwithſtanding this ſentence, however, the attorney-general, contrary to the uſual cuſtom in ſuch caſes, was directed to move that the judgment might not be recorded; being afraid of the conſequences. Yet it was judged that the king might ſeize the liberties of the city. A common-council was immediately ſummoned to deliberate on this exigency. The country party moved to have the judgment entered; but they were over-ruled by the court-party, who inſiſted upon an abſolute ſubmiſſion to the king before judgment was entered; and though this was in effect a voluntary ſurrender of the city liberties, and depriving themſelves of the means of getting the judgment reverſed, the act of ſubmiſſion was carried by a great majority: and in a petition from the lord-mayor, aldermen, and common-council, they "acknowledged their own miſgovernment, and his majeſty's lenity; begged his pardon, and promiſed conſtant loyalty and obedience; and humbly begged his majeſty's commands and directions." To this his majeſty anſwered, that he would not reject their ſuit, if they would agree upon the following particulars. 1. That no lord-mayor, ſheriff, recorder, common ſerjeant, town-clerk, or coroner, of the city of London, or ſteward of the borough of Southwark, ſhall be capable of, or admitted to, the exerciſe of their reſpective offices before his majeſty ſhall have approved of them under his ſign manual. 2. That if his majeſty ſhall diſapprove the choice of any perſon to be lord mayor, and ſignify the ſame under his ſign manual to the lord mayor, or, in default of a lord mayor, to the recorder or ſenior alderman, the citizens ſhall, within one week, proceed to a new choice; and if his majeſty ſhall in like manner diſapprove the ſecond choice, his majeſty may, if he pleaſes, nominate a perſon to be lord mayor for the year enſuing. 3. If his majeſty ſhall, in like manner, diſapprove the perſons choſen to be ſheriffs, or either of them, his majeſty may appoint ſheriffs for the year enſuing. 4. That the lord mayor and court of aldermen may, with the leave of his majeſty, diſplace any alderman, recorder, &c. 5. Upon the election of an alderman, if the court of aldermen ſhall judge and declare the perſon preſented to be unfit, the ward ſhall chooſe again; and upon a diſapproval of a ſecond choice, the court may appoint another in his room. 6. That the juſtices of the peace ſhould be by the king's commiſſion; and the ſettling of thoſe matters to be left to his majeſty's attorney-general, and counſel learned in the law." London.

27 Conditions of reconciliation between the king and city.

To theſe the lord keeper added, in the king's name, "That theſe regulations being made, his majeſty would not only pardon this proſecution, but would confirm their charter in ſuch a manner as ſhould be conſiſtent with them;" concluding thus: "My lord mayor, the term draws towards an end, and Midſummer-day is at hand, when ſome of the officers uſed to be choſen; whereof his majeſty will reſerve the approbation. Therefore, it is his majeſty's pleaſure, that you return to the city, and conſult the common-council, that he may ſpeedily know your reſolutions thereupon, and accordingly give his directions. That you may ſee the king is in earneſt, and the matter is not capable of delay, I am commanded to let you know he hath given orders to his attorney-general to enter upon judgment on Saturday next; unleſs you prevent it by your compliance in all theſe particulars."

A common-council was ſummoned, when the friends of liberty treated thoſe ſlaviſh conditions as they deſerved; and even declared, that they were ready to ſacrifice all that was near or dear to them, rather than ſubmit to ſuch arbitrary impoſitions: but when it was put to the vote, there appeared a majority of 18 for ſubmiſſion.

28 The king breaks his promiſe.

Thus the king got the government of the city into his own hands, though he and his brothers entirely loſt the affections of the Londoners. But, not content with their ſubmiſſion, his majeſty departed from his promiſe; commanded the judgment upon the *quo warranto* to be entered; and commiſſioned Sir William Pritchard, the lord mayor, to hold the ſame office during his majeſty's pleaſure. In the ſame manner he appointed or diſplaced the other magiſtrates as he thought proper; after which the miniſtry, having nothing to fear, proceeded in the moſt arbitrary manner.

29 Privileges of the city reſtored.

In this ſubjection to the will of the court, the city of London continued till the Revolution: but, in 1689, the immediate reſtoration of the Londoners to their franchiſes was ordered; and in ſuch a manner and form, as to put it out of the powers of an arbitrary miniſtry and a corrupt judge and jury to deprive them of their chartered liberties for the time to come. Accordingly a bill was brought into parliament, and paſſed, for reverſing the judgment of the *quo warranto* againſt the city of London, and for reſtoring the ſame to its ancient rights and privileges. Since that time the city of London hath enjoyed tranquillity; its commerce hath been carried to the higheſt pitch; and for the politeneſs, riches, and number of its inhabitants, as well as its extent and the magnificence of its buildings, is inferior to no city in Europe, if not ſuperior to every one.

30 Deſcription of the city.

That part of this immenſe capital which is diſtinguiſhed by the name of *The City*, ſtands on the north ſhore of the river, from the Tower to the Temple, occupying only that ſpace formerly encompaſſed by the wall, which in circumference meaſures but three miles and 165 feet. In this wall there were ſeven gates by land, viz. Ludgate, Aldgate, Cripplegate, Alderſgate, Moorgate, Biſhopſgate, which were all taken down in September 1760; and Newgate, the county gaol, which was alſo taken down in 1776, and a maſſive building

London. building erected a little ſouth of it, which by the rioters in 1780 received damage to the amount of L.80,000. On the ſide of the water there were Dowgate and Billingſgate, long ſince demoliſhed, as well as the poſtern-gate near the Tower. In the year 1670 there was a gate erected called Temple-Bar, which terminates the bounds of the city weſtward. The *liberties*, or thoſe parts of this great city which are ſubject to its juriſdiction and lie without the walls of London, are bounded on the eaſt, in White-chapel, the Minories, and Biſhopſgate, by bars, which were formerly poſts and chains, that were frequently taken away by arbitrary power, when it was thought proper to ſeize the franchiſes of the city of London: on the north, they are bounded in the ſame manner in Pick-ax ſtreet, at the end of Fan-alley, and in St John's ſtreet: on the weſt, by bars in Holborn: at the eaſt end of Middle Row, and at the weſt end of Fleet-ſtreet, by the gate called *Temple-Bar*, already mentioned: on the ſouth, we may include the juriſdiction which the city holds on the river Thames, and over the borough of Southwark.

The city, including the borough, is at preſent divided into 26 wards.

31 Diviſion into wards.

1. *Alderſgate ward* takes its name from a city-gate which lately ſtood in the neighbourhood. It is bounded on the eaſt by Cripplegate ward; on the weſt, by Farringdon ward within and without; and on the ſouth, by Farringdon ward within. It is very large, and is divided into Alderſgate-within and Alderſgate-without. Each of theſe diviſions conſiſts of four precincts, under one alderman, eight common-council men, of whom two are the alderman's deputies, eight conſtables, fourteen inqueſt-men, eight ſcavengers, and a beadle; excluſive of the officers belonging to the liberty of St Martin's le Grand, which contains 168 houſes.

2. *Aldgate* takes its name alſo from a gate, which was of great antiquity, being mentioned in king Edgar's charter to the knights of the Knighton Guild about the year 967; and was probably of a much more ancient foundation, for it was the gate through which the Roman Vicinal way lay to the ferry at Oldford. In the time of the wars betwixt king John and his barons, the latter entered the city through this gate, and committed great devaſtations among the houſes of the religious. Aldgate was rebuilt by the leaders of the party after the Roman manner. They made uſe of ſtone which they brought from Caen, and a ſmall brick called the *Flanders tile*, which Mr Pennant thinks has been often miſtaken for Roman. The new gate was very ſtrong, and had a deep well within it. In 1471 this gate was aſſaulted by the Baſtard of Falconbridge, who got poſſeſſion of it for a few hours; but the portcullis being drawn up, the troops which had entered were all cut off, and the citizens, headed by the alderman of the ward and recorder, having made a ſally, defeated the remainder with great ſlaughter. In 1606 Aldgate was taken down and rebuilt; and many Roman coins were found in digging the foundations.—The ward of Aldgate is bounded on the eaſt by the city-wall, which divides it from Portſoken-ward; on the north, by Biſhopſgate ward; on the weſt, by Lime-ſtreet and Langbourn wards; and on the ſouth, by Tower-ſtreet ward. It is governed by an alderman, ſix common-council men, ſix conſtables, twenty inqueſt-men, ſeven ſcavengers, and a beadle; beſides the officers belonging to St James's, Duke's Place.—It is divided into ſeven precincts. London.

3. *Baſſiſhaw* or *Baſinghall ward*, is bounded on the eaſt and ſouth by Coleman-ſtreet ward, on the north by part of Cripplegate, and on the weſt by part of the wards of Cheap and Cripplegate. On the ſouth, it begins at Blackwell-hall; and runs northward to London-wall, pulled down ſome time ago to make way for new buildings in *Fore-ſtreet*, and ſpreads 88 feet eaſt, and 54 feet weſt againſt the place where that wall ſtood. This is a very ſmall ward, and conſiſts only of two precincts: the upper precinct contains no more than 66, and the lower only 76 houſes. It is governed by an alderman, four common-council men, of whom one is the alderman's deputy, three conſtables, ſeventeen inqueſt-men, three ſcavengers, and a beadle. It has its name from Baſinghall, the manſion-houſe of the family of *Baſin s*, which was the principal houſe in it, and ſtood in the place of Blackwell-hall.

4. *Billingſgate ward* is bounded on the eaſt by Tower-ſtreet ward; on the north, by Langbourn ward; on the weſt, by the ward of Bridge-within; and on the ſouth, by the river Thames. There have been many conjectures concerning the origin of the name of *Billingſgate*, none of which ſeems to be very well authenticated. It is, for inſtance, ſuppoſed to have derived its name from a Britiſh king named *Belinus*, ſaid to have been an aſſiſtant of Brennus king of the Gauls at the taking of Rome, and is the ſame with the *Beli-Maur* mentioned in the Welſh genealogies. The name of *Ludgate* is ſaid to be derived from his ſon *Lud*.—It is divided into 12 precincts; and is governed by an alderman, 10 common-council men, one of whom is the alderman's deputy, 11 conſtables, 14 inqueſt-men, ſix ſcavengers, and a beadle. The ſituation of Billingſgate, on the river, gives it great advantages with reſpect to trade and merchandize; ſo that it is well inhabited, and is in a continual hurry of buſineſs at the ſeveral wharfs or quays.

5. *Biſhopſgate ward* is bounded on the eaſt by Aldgate ward, Portſoken ward, and part of the Tower-liberty, or Norton-falgate; on the weſt, by Broad-ſtreet ward and Moorfields; and on the ſouth, by Langbourn ward. It is very large, and divided into Biſhopſgate-within and Biſhopſgate-without. The firſt contains all that part of the ward within the city-wall and gate, and is divided into five precincts; the ſecond lies without the wall, and is divided into four precincts. Biſhopſgate-without extends to Shoreditch, taking its name from one Sir John de Sordich, an eminent lawyer much in favour with king Edward III. both on account of his knowledge in the law, and of his perſonal valour. In the time of Henry VIII. one Barlo, a citizen and inhabitant of this place, was named *duke of Shoreditch*, on account of his ſkill in archery; and, for a number of years after, the title belonged to the captain of the London archers. This ward is governed by an alderman, two deputies, one within and the other without, 12 common-council men, ſeven conſtables, 13 inqueſt-men, nine ſcavengers, and two beadles. It took its name from the gate, which has been pulled down to make that part of the city more airy and commodious. This gate was built by Erkenwald

London. Erkenwald biſhop of London in 675; and it is ſaid to have been repaired by William the Conqueror ſoon after the Norman conqueſt. In the time of Henry III. the Hanſe merchants had certain privileges confirmed to them, in return for which they were to ſupport this gate; and in conſequence of this they rebuilt it elegantly in 1479. There were two ſtatues of biſhops, in memory of the founder and firſt repairer; other two were alſo put up, which are ſuppoſed to have been deſigned for Alfred and Ældred earl of Mercia, to whoſe care the gate had been committed.

6. *Bread-ſtreet ward* is encompaſſed, on the north and north-weſt, by the ward of Fardingdon-within; on the eaſt, by Cordwainer's ward; on the ſouth by Queenhithe-ward; and on the weſt, by Caſtle-Baynard ward. It is divided into 13 precincts; and is governed by an aldermen, 12 common council-men, of whom one is the alderman's deputy, 13 conſtables, 13 inqueſt-men, 13 ſcavengers, and a beadle; and yet contains no more than 331 houſes. It takes its name from the ancient bread-market, which was kept in the place now called *Bread-ſtreet;* the bakers being obliged to ſell their bread only in the open market and not in ſhops.

7. *Bridge-ward within* is bounded on the ſouth by the river Thames and Southwark; on the north, by Langbourn and Biſhopſgate ward; on the eaſt, by Billingſgate; and on the weſt, by Candlewick and Dowgate wards. It is divided into 14 precincts, three of which were on London-bridge; and is governed by an alderman, 15 common-council men, one of whom is the alderman's deputy, 14 conſtables, 15 inqueſt-men, 14 ſcavengers, and a beadle. It takes its name from its connection with London-bridge.

8. *Broad-ſtreet ward* is bounded, on the north and eaſt, by Biſhopſgate ward; on the ſouth, by Cornhill and Wallbrook ward; and on the weſt by Coleman-ſtreet ward. It is divided into 10 precincts; and governed by an alderman, 10 common-council men, one of whom is the alderman's deputy, 10 conſtables, 13 inqueſt-men, eight ſcavengers, and a beadle. It has its name from that part of it now diſtinguiſhed by the name of *Old Broad ſtreet;* and which, before the fire of 1666, was accounted one of the broadeſt ſtreets in London.

9. *Candlewick ward*, *Candlewick-ſtreet*, or *Candlewright ſtreet ward* as it is called in ſome ancient records, is bounded on the eaſt by Bridge ward; on the ſouth, by Dowgate and part of Bridge ward; on the weſt, by Dowgate and Wallbrook; and on the north, by Langbourn ward. It is but a ſmall ward, conſiſting of about 286 houſes; yet is divided into ſeven precincts. It is governed by an alderman, eight common-council men, of whom one is the alderman's deputy, ſeven conſtables, 13 inqueſt-men, ſeven ſcavengers, and a beadle. It has its name from a ſtreet, formerly inhabited chiefly by candle wrights or candlemakers, both in tallow and wax: a very profitable buſineſs in the times of Popery, when incredible quantities of wax-candles were conſumed in the churches. That ſtreet, however, or at leaſt its name, *Candlewick*, is loſt ſince the great conflagration, for which the name *Canon-ſtreet* is ſubſtituted, the candle wrights being at that time burnt out and diſperſed through the city.

10. *Caſtle-Baynard ward* is bounded by Queenhithe and Bread-ſtreet wards on the eaſt; on the ſouth, by the Thames; and on the weſt and north, by the ward of Farringdon-within. It is divided into 10 precincts, under the govermnent of an alderman, 10 common council-men, one of whom is the alderman's deputy, nine conſtables, 14 inqueſt-men, ſeven ſcavengers, and a beadle. It takes its name from a caſtle built on the bank of a river by one Baynard, a ſoldier of fortune, who came in with William the Conqueror, and was by that monarch raiſed to great honours and authority.

11. *Cheap ward* is bounded on the eaſt by Broadſtreet and Wallbrook wards; on the north, by Coleman-ſtreet, Baſſiſhaw, and Cripplegate; and on the ſouth, by Cordwainer's ward. It is divided into nine precincts; and is governed by an alderman, 12 common-council men, of whom one is the alderman's deputy, 11 conſtables, 13 inqueſt-men, nine ſcavengers, and a beadle. It has its name from the Saxon word *chepe*, which ſignifies a market, kept in this diviſion of the city, now called *Cheapſide;* but then known by the name of *Weſtcheap*, to diſtinguiſh it from the market then alſo kept in Eaſtcheap, between Canon or Candlewick ſtreet and Tower-ſtreet.

12. *Coleman-ſtreet ward* is bounded on the eaſt by Biſhopſgate, Broadſtreet, and Cheap wards; on the north, by Cripple-gate ward, Middle Moorfields, and Biſhopſgate; on the ſouth, by Cheap ward; and on the weſt, by Baſſiſhaw ward. It is divided into ſix precincts; and is governed by an alderman, ſix common-council men, one of whom is the alderman's deputy, ſix conſtables, 13 inqueſt-men, ſix ſcavangers, and a beadle. The origin of the name is not certainly known.

13. *Cordwainers ward* is bounded on the eaſt by Wall-brook, on the ſouth by Vintry ward, on the weſt by Bread-ſtreet, and on the north by Cheap-ward. It is divided into eight precincts; and is governed by an alderman, eight common-council men, one of whom is the alderman's deputy, eight conſtables, 14 inqueſt men, eight ſcavangers, and a beadle. Its proper name is *Cordwainers-ſtreet ward;* which it has from Cordwainers ſtreet, now Bow-lane, formerly occupied chiefly by ſhoemakers and others that dealt or worked in leather.

14. *Cornhill ward* is but of ſmall extent. It is bounded on the eaſt by Biſhopſgate, on the north by Broad ſtreet, on the weſt by Cheap ward, and on the ſouth by Langbourn ward. It is divided into four precincts, which are governed by one alderman, ſix common-council men, of whom one is the alderman's deputy, four conſtables, 16 inqueſt-men, four ſcavengers, and a beadle. It takes its name from the principal ſtreet in it, known from the earlieſt ages by the name of *Cornhill*, becauſe the corn-market was kept there.

15. *Cripplegate ward* is bounded on the eaſt by Moorfields, Coleman-ſtreet ward, Baſſiſhaw ward, and Cheap ward; on the north by the pariſh of St Luke's, Old-ſtreet; on the weſt, by Alderſgate ward; and on the ſouth, by Cheap-ward. It is divided into 13 precincts, nine within and four without the wall; and is governed by an alderman, 12 common council men, of whom two are the alderman's deputies, 13 conſtables, 34 inqueſt-men, 16 ſcavengers, and three beadles. It takes

London. takes its name from Cripplegate, which ſtood on the north-weſt part of the city-wall. It was an old plain ſtructure, void of all ornament, with one poſtern; but had more the appearance of a fortification than any of the other gates. It was removed in order to widen the entrance into Wood-ſtreet, which, by the narrowneſs of the gateway, was too much contracted and rendered dangerous for paſſengers and great waggons.

16. *Dowgate ward* is bounded on the eaſt by Candlewick and Bridge wards, on the north by Wallbrook ward, on the weſt by Vintry ward, and on the ſouth by the Thames. It is divided into eight precincts, under the government of an alderman, eight common-council men, of whom one is the alderman's deputy, eight conſtables, 15 inqueſt-men, five ſcavengers, and a beadle. It has its name from the ancient water-gate, called *Dourgate*, which was made in the original wall that ran along the north ſide of the Thames, for the ſecurity of the city againſt all attempts to invade it by water.

17. *Farringdon ward within* is bounded on the eaſt by Cheap ward and Baynard-caſtleward; on the north, by Alderſgate and Cripplegate wards, and the liberty of St Martin's le Grand; on the weſt, by Farringdon-without; and on the ſouth, by Baynard-caſtle ward, and the river Thames. It is divided into 18 precincts; and governed by one alderman, 17 common-council men, of whom one is the alderman's deputy, 19 conſtables, 17 inqueſt-men, 19 ſcavengers, and two beadles. It takes its name from William Farringdon citizen and goldſmith of London, who, in 1279, purchaſed all the aldermanry with the appurtenances, within the city of London and ſuburbs of the ſame, between Ludgate and Newgate, and alſo *without* theſe gates.

18. *Farringdon-ward without* is bounded on the eaſt by *Farringdon within*, the precinct of the late priory of St Bartholomew near Smithfield, and the ward of Alderſgate; on the north, by the charter-houſe, the pariſh of St John's Clerkenwell, and part of St Andrew's pariſh without the freedom; on the weſt, by High Holborn and St Clement's pariſh in the Strand; and on the South by the river Thames. It is governed by one alderman, 16 common-council men, of whom two are the alderman's deputies, 23 conſtables, 48 inqueſt-men; 24 ſcavengers; and four beadles. It takes its name from the ſame goldſmith who gave name to Farringdon-within.

19. *Langhorn ward* is bounded on the eaſt by Aldgate ward; on the north, by part of the ſame, and Limeſtreet ward; on the ſouth, by Tower-ſtreet, Billingſgate, Bridge, and Candlewick wards; and on the weſt by Wallbrook. It is divided into 12 precincts. It had its name from a rivulet or long bourn of freſh-water, which anciently flowed from a ſpring near Magpye alley adjoining to St Catherine Coleman's church.

20. *Limeſtreet ward* is bounded on the eaſt and north by *Aldgate ward*, on the weſt by Biſhopſgate; and on the ſouth by Langbourn ward. It is divided into four precincts; and governed by an alderman, four common-council men, one of whom is the alderman's deputy, four conſtables, 13 inqueſt-men, four ſcavengers, and a beadle. It is very ſmall; and has its name from ſome lime-kilns that were formerly built in or near Lime-ſtreet. London.

21. *Portſoken ward* is bounded on the eaſt by the pariſhes of Spitalfields, Stepney, and St George's in the eaſt; on the ſouth, by Tower-hill; on the north, by Biſhopſgate ward, and on the weſt by Aldgate ward. It is divided into five precincts; and is governed by an alderman, five common-council men, one of whom is the alderman's deputy, five conſtables, 19 inqueſt-men, five ſcavengers, and a beadle. Its name ſignifies the *franchiſe of the liberty gate*. This Portſoken was for ſome time a guild; and had its beginning in king Edgar, when 13 knights, "well-beloved of the king and realm, for ſervices by them done," requeſted to have a certain portion of land on the eaſt part of the city left deſolate and forſaken of the inhabitants by reaſon of too much ſervitude. They beſought the king to have this land, with the liberty of a guild for ever. The king granted their requeſt on the following conditions, *viz.* that each of them ſhould victoriouſly accompliſh three combats, one above the ground, one under ground, and the third in the water: and after this, at a certain day, in Eaſt Smithfield, they ſhould run with ſpears againſt all comers. All this was glorioufly performed; upon which the king named it *Knighten Guild*, and extended it from Aldgate to the places where the bars now are on the eaſt, and to the Thames on the ſouth, and as far into the water as an horſeman could ride at low water and throw his ſpear.

22. *Queen-hithe ward* is bounded on the eaſt by Dowgate, on the north by Bread-ſtreet and Cordwainers wards, on the ſouth by the Thames, and on the weſt by Caſtle-Baynard ward. It is divided into nine precincts; and is governed by one alderman, ſix common-council men, one of whom is the alderman's deputy, and nine conſtables. It has its name from the *hithe*, or harbour for large boats, barges, and lighters; for which, and even for ſhips, it was the anchoring place, and the key for lading and unloading veſſels almoſt of any burden uſed in ancient times. It has the name of *queen*, becauſe the queens of England uſually poſſeſſed the tolls and cuſtoms of veſſels that unloaded goods at this hithe, which were very conſiderable.

23. *Tower ward*, or *Tower-ſtreet ward*, is bounded on the ſouth by the river Thames, on the eaſt by Tower-hill and Aldgate ward, on the north by Langbourn ward, and on the weſt by Billingſgate ward. It is governed by one alderman, 12 common-council men, of whom one is the alderman's deputy, 12 conſtables, 13 inqueſt men, 12 ſcavengers, and one beadle. It takes its name from *Tower-ſtreet*, ſo called becauſe it leads out of the city in a direct line to the principal entrance of the Tower of London.

24. *Vintry ward* is bounded on the eaſt by Dowgate, on the ſouth by the Thames, on the weſt by Queen-hithe ward, and on the north by Cordwainers ward. It is a ſmall ward, containing only 418 houſes; but is divided into nine precincts, and governed by an alderman, nine common-council men, one of whom is the alderman's deputy, nine conſtables, 13 inqueſt-men, three ſcavengers, and a beadle. It takes its name from the vintners or wine-merchants of Bourdeaux, who formerly dwelt in this part of the city, were obliged to land their wines on this ſpot, and to ſell them in 40 days, till the 28th of Edward I.

London. 25. *Wall-brook ward* is bounded on the eaſt by Langbourn, on the ſouth by Dowgate ward, on the weſt by Cordwainers ward, and on the north by Cheap ward. It is ſmall, containing only 306 houſes; but is divided into ſeven precincts, and governed by an alderman, eight common-council men, of whom one is the alderman's deputy, ſeven conſtables, 13 inqueſtmen, ſix ſcavengers, and a beadle. It has its name from the rivulet *Wall-brook*, that ran down the ſtreet of this name into the river Thames near Dowgate; but in proceſs of time it was ſo loſt by covering it with bridges and buildings upon thoſe bridges, that its channel became a common ſewer.

26. The ward of *Bridge-without* includes the borough of Southwark, and the pariſhes of Rotherhithe, Newington, and Lambeth. It has its name from London-bridge, with the addition of the word *without*, becauſe the bridge muſt be paſſed in order to come at it. *Weſtminſter* is generally reckoned a part of London, tho' under a diſtinct government; and has long been famous for the palaces of our kings, the ſeat of our law tribunals, and of the high court of parliament; all which ſhall be deſcribed in their order.

32 Government of London. The city and liberties of London are under an eccleſiaſtical, a civil, and a military government.

33 Eccleſiaſtical. As to its *eccleſiaſtical* government, London is a biſhop's ſee, the dioceſe of which comprehends not only Middleſex, Eſſex, and part of Hertfordſhire, but the Britiſh plantations in America. The biſhop of London takes precedency next to the archbiſhops of Canterbury and York; but the following pariſhes of this city are exempt from his juriſdiction, being peculiars under the immediate government of the archbiſhop of Canterbury; *viz.* All-hallows in Bread-ſtreet, All-hallows Lombard-ſtreet; St Dionys Back-church, St Dunſtan in the Eaſt, St John Baptiſt, St Leonard Eaſtcheap, St Mary Aldermary, St Mary Bothaw, St Mary le Bow, St Michael Crooked-lane, St Michael Royal, St Pancras Soper-lane, and St Vedaſt Foſter-lane.

34 Civil. The *civil* government of London divides it into wards and precincts, under a lord-mayor, aldermen, and common-council.

35 Lord-mayor. The mayor, or lord-mayor, is the ſupreme magiſtrate, choſen annually by the citizens, purſuant to a charter of King John. The preſent manner of electing a lord-mayor is by the liverymen of the ſeveral companies, aſſembled in Guildhall annually on Michaelmas-day, according to an act of common council in A. D. 1476, where, and when, the liverymen chooſe, or rather nominate, two aldermen below the chair, who have ſerved the office of ſheriff, to be returned to the court of aldermen, who may chooſe either of the two; but generally declare the ſenior of the two, ſo returned, to be lord-mayor elect. The election being over, the lord-mayor elect, accompanied by the recorder and divers aldermen, is ſoon after preſented to the lord-chancellor (as his majeſty's repreſentative in the city of London) for his approbation; and on the 9th of November following is ſworn into the office of mayor at Guildhall; and on the day after, before the barons of the exchequer at Weſtminſter; the proceſſion on which occaſion is exceedingly grand and magnificent.

The lord-mayor ſits every morning at the manſion-houſe, or place where he keeps his mayoralty, to determine any difference that may happen among the citizens, and to do other buſineſs incident to the office of a chief magiſtrate. Once in ſix weeks, or eight times in the year, he ſits as chief judge of Oyer and Terminer, or gaol-delivery of Newgate for London and the county of Middleſex. His juriſdiction extends all over the city and ſuburbs, except ſome places that are exempt. It extends alſo from Colneyditch, above Staines-bridge in the weſt, to Yeudale, or Yenflete, and the mouth of the river Medway, and up that river to Upnor-caſtle, in the eaſt: by which he exerciſes the power of puniſhing or correcting all perſons that ſhall annoy the ſtreams, banks, or fiſh. For which purpoſe his lordſhip holds ſeveral *courts of conſervancy* in the counties adjacent to the ſaid river, for its conſervation, and for the puniſhment of offenders. See the article MAYOR's-*Court*.

35 Aldermen. The title of dignity, *alderman*, is of Saxon original, and of the greateſt honour, anſwering to that of earl; though now it is nowhere to be found but in chartered ſocieties. And from hence we may account for the reaſon why the aldermen and commonalty of London were called *barons* after the conqueſt. Theſe magiſtrates are properly the ſubordinate governors of their reſpective wards under the lord-mayor's juriſdiction: and they originally held their aldermanries either by inheritance or purchaſe; at which time the aldermanries or wards changed their names as often as their governors or aldermen. The oppreſſions, to which the citizens were ſubject from ſuch a government, put them upon means to aboliſh the perpetuity of that office; and they brought it to an annual election. But that manner of election being attended with many inconveniences, and becoming a continual bone of contention amongſt the citizens, the parliament, 17 Richard II. A. D. 1394, enacted, That the aldermen of London ſhould continue in their ſeveral offices during life or good behaviour. And ſo it ſtill continues: though the manner of electing has ſeveral times varied. At preſent it is regulated by an act of parliament, paſſed in the year 1724-5: and the perſon ſo elected is to be returned by the lord-mayor (or other returning officer in his ſtead, duly qualified to hold a court of wardmote) to the court of lord-mayor and aldermen, by whom the perſon ſo returned muſt be admitted and ſworn into the office of alderman before he can act. If the perſon choſen refuſeth to ſerve the office of alderman, he is finable 500 l.

Theſe high officers conſtitute a ſecond part of the city legiſlature when aſſembled in a corporate capacity, and exerciſe an executive power in their reſpective wards. The aldermen who have paſſed the chair, or ſerved the high office of lord-mayor, are juſtices of the quorum; and all the other aldermen are not only juſtices of the peace, but by the ſtatute of 43 Eliz. intitled, *An act for the relief of the poor*, "every alderman of the city of London, within his ward, ſhall and may do and execute, in every reſpect, ſo much as is appointed and allowed by the ſaid act to be done or executed by one or *two* juſtices of peace of any county within this realm." They every one keep their *wardmote*, or *court*, for chooſing ward-officers and ſettling the affairs of the ward, to redreſs grievances, and to preſent all defaults found within their reſpective wards.

The next branch of the legiſlative power in this

London. 36 Common-council.

city is the *common-council.* The many inconveniences that attended popular aſſemblies, which were called *folkmote*, determined the commonalty of London to chooſe repreſentatives to act in their name and for their intereſt, with the lord-mayor and aldermen, in all affairs relating to the city. At firſt theſe repreſentatives were choſen out of the ſeveral companies: but that not being found ſatisfactory, nor properly the repreſentatives of the whole body of the inhabitants, it was agreed to chooſe a certain number of diſcreet men out of each ward: which number has from time to time increaſed according to the dimenſions of each ward: and at preſent the 25 wards, into which London is divided, being ſubdivided into 236 precincts, each precinct ſends a repreſentative to the common-council, who are elected after the ſame manner as an alderman, only with this difference, that as the lord-mayor preſides in the wardmote, and is judge of the poll at the election of an alderman, ſo the alderman of each ward is judge of the poll at the election of a common-council man.

Thus the lord-mayor, aldermen, and common-council, when aſſembled, may be deemed the city parliament, reſembling the great council of the nation. For it conſiſts of two houſes; one for the lord-mayor and aldermen, or the upper-houſe; another for the commoners or repreſentatives of the people, commonly called the *common-council men.* And they have power in their incorporate capacity to make and repeal bye-laws; and the citizens are bound to obey or ſubmit to thoſe laws. When they meet in their incorporate capacity, they wear deep-blue ſilk gowns: and their aſſemblies are called the *court of common-council*, and their ordinances *acts of common council.* No act can be performed in the name of the city of London without their concurrence. But they cannot aſſemble without a ſummons from the lord-mayor; who, nevertheleſs, is obliged to call a common-council, whenever it ſhall be demanded, upon extraordinary occaſions, by ſix reputable citizens and members of that court.

37 Sheriffs.

This corporation is aſſiſted by two ſheriffs and a recorder. The ſheriffs are chartered officers, to perform certain ſuits and ſervices, in the king's name, within the city of London and county of Middleſex, choſen by the liverymen of the ſeveral companies on Midſummer day. Their office, according to Cambden, in general, is to collect the public revenues within their ſeveral juriſdictions; to gather into the exchequer all fines belonging to the crown; to ſerve the king's writs of proceſs; to attend the judges, and execute their orders; to impannel juries; to compel headſtrong and obſtinate men by the *poſſe comitatus* to ſubmit to the deciſions of the law; and to take care that all condemned criminals be duly puniſhed and executed. In particular, in London, they are to execute the orders of the common-council, when they have reſolved to addreſs his majeſty, or to petition parliament.

The ſheriffs, by virtue of their office, hold a court at Guildhall every Wedneſday and Friday, for actions entered at Wood-ſtreet Compter; and on Thurſdays, and Saturdays for thoſe entered at the Poultry Compter: of which the ſheriffs being judges, each has his aſſiſtant, or deputy, who are called the judges of thoſe courts; before whom are tried actions of debt, treſpaſs, covenant, &c. and where the teſtimony of any abſent witneſs in writing is allowed to be good evidence. To each of theſe courts belong four attornies, who, upon their being admitted by the court of aldermen, have an oath adminiſtered to them. London.

To each of theſe courts likewiſe belong a ſecondary, a clerk of the papers, a prothonotary, and four clerks-ſitters. The ſecondary's office is to allow and return all writs brought to remove clerks out of the ſaid courts; the clerk of the papers files and copies all declarations upon actions; the prothonotary draws and ingroſſes all declarations; the clerk-ſitters enter actions and attachments, and take bail and verdicts. To each of the compters, or priſons belonging to theſe courts, appertain 16 ſerjeants at mace, with a yeoman to each, beſides inferior officers, and the priſon-keeper.

In the ſheriffs court may be tried actions of debt, caſe, treſpaſs, account, covenant, and all perſonal actions, attachments, and ſequeſtrations. When an erroneous judgment is given in either of the ſheriffs courts of the city, the writ of error to reverſe this judgment muſt be brought in the court of huſtings before the lord mayor; for that is the ſuperior court. The ſheriffs of London may make arreſts and ſerve executions on the river Thames.

38 Recorder.

We do not read of a recorder till the 1304, who, by the nature of his office, ſeems to have been intended as an aſſiſtant to, or aſſeſſor with, the lord-mayor, in the execution of his high office, in matters of juſtice and law. He is choſen by the lord-mayor and aldermen only; and takes place in all courts, and in the common-council, before any one that hath not been mayor. Of whom we have the following deſcription in one of the books of the chamber. "He ſhall be, and is wont to be, one of the moſt ſkilful and virtuous apprentices of the law of the whole kingdom; whoſe office is always to ſit on the right hand of the mayor, in recording pleas, and paſſing judgments; and by whom records and proceſſes, had before the lord-mayor and aldermen at Great St Martin's, ought to be recorded by word of mouth before the judges aſſigned there to correct errors. The mayor and aldermen have therefore uſed commonly to ſet forth all other buſineſſes, touching the city, before the king and his council, as alſo in certain of the king's courts, by Mr Recorder, as a chief man, endued with wiſdom, and eminent for eloquence."—Mr Recorder is looked upon to be the mouth of the city, to deliver all addreſſes to the king, &c. from the corporation; and he is the firſt officer in order of precedence that is paid a ſalary, which originally was no more than 10 l. Sterling *per annum*, with ſome few perquiſites; but it has from time to time been augmented to 1000 l. *per annum*, and become the road to preferment in the law. This office has ſometimes been executed by a deputy.

39 Chamberlain.

The next chartered officer of this corporation is the chamberlain; an office of great repute and truſt, and is in the choice of the livery annually. This officer, though choſen annually on Midſummer-day, is never diſplaced during his life, except ſome very great crime can be made out againſt him. He has the keeping of the moneys, lands, and goods, of the city-orphans, or takes good ſecurity for the payment thereof when the parties come to age. And to that end he is deemed in the law a ſole corporation, to him and his ſucceſ-

ſors,

London. sors, for orphans; and therefore a bond or a recognizance made to him and his ſucceſſors, is recoverable by his ſucceſſors. This officer hath a court peculiarly belonging to him. His office may be termed a public treaſury, collecting the cuſtoms, moneys, and yearly revenues, and all other payments belonging to the corporation of the city. It was cuſtomary for government to appoint the chamberlain receiver of the land tax; but this has been diſcontinued for ſeveral years paſt.

40 Other officers. The other officers under the lord-mayor are, 1. The common ſerjeant. He is to attend the lord-mayor and court of aldermen on court-days, and to be in council with them on all occaſions, within or without the precincts or liberties of the city. He is to take care of orphans eſtates, either by taking account of them, or to ſign their indentures, before their paſſing the lord-mayor and court of aldermen. And likewiſe he is to let, ſet, and manage the orphans eſtates, according to his judgment, to the beſt advantage. 2. The town-clerk; who keeps the original charter of the city, the books, rolls, and other records, wherein are regiſtered the acts and proceedings of the city; ſo that he may not be improperly termed the city-regiſter: he is to attend the lord-mayor and aldermen at their courts, and ſigns all public inſtruments. 3. The city-remembrancer; who is to attend the lord-mayor on certain days, his buſineſs being to put his lordſhip in mind of the ſelect days he is to go abroad with the aldermen, &c. He is to attend daily at the parliament-houſe, during the ſeſſions, and to report to the lord-mayor their tranſactions. 4. The ſword-bearer; who is to attend the lord-mayor at his going abroad, and to carry the ſword before him, being the emblem of juſtice This is an ancient and honourable office, repreſenting the ſtate and princely office of the king's moſt excellent majeſty, in his repreſentative the lord-mayor; and, according to the rule of armory, "He muſt carry the ſword upright, the hilts being holden under his bulk, and the blade directly up the midſt of his breaſt, and ſo forth between the ſword-bearer's brows." 5. The common-hunt; whoſe buſineſs it is to take care of the pack of hounds belonging to the lord-mayor and citizens, and to attend them in hunting in thoſe grounds to which they are authoriſed by charter. 6. The common-crier. It belongs to him and the ſerjeant at arms, to ſummon all executors and adminiſtrators of freemen to appear, and to bring in inventories of the perſonal eſtates of freemen, within two months after their deceaſe: and he is to have notice of the appraiſements. He is alſo to attend the lord-mayor on ſet days, and at the courts held weekly by the mayor and aldermen. 7. The water-bailiff; whoſe office is to look after the preſervation of the river Thames againſt all encroachments; and to look after the fiſhermen for the preſervation of the young fry, to prevent the deſtroying them by unlawful nets. For that end, there are juries for each county, that hath any part of it lying on the ſides or ſhores of the ſaid river; which juries, ſummoned by the water-bailiff at certain times, do make inquiry of all offences relating to the river and the fiſh, and make their preſentments accordingly. He is alſo bound to attend the lord-mayor on ſet days in the week.—Theſe ſeven purchaſe their places; except the town-clerk, who is choſen by the livery.

There are alſo three ſerjeant-carvers; three ſerjeants of the chamber; a ſerjeant of the channel: four yeomen of the water-ſide; an under water-bailiff; two yeomen of the chamber; two meal-weighters; two yeomen of the wood wharfs; a foreign taker; city-marſhals. There are beſides theſe, ſeven gentlemens men; as, the ſword-bearer's man, the common-hunt's two men, the common crier's man, and the carver's three men. London.

Nine of the foregoing officers have liveries of the lord-mayor, *viz.* the ſword-bearer and his man, the three carvers, and the four yeomen of the water-ſide. All the reſt have liveries from the chamber of London.

The following officers are likewiſe belonging to the city; farmer of the markets, auditor, clerk of the chamber, clerk to the commiſſioners of the ſewers, clerk of the court of conſcience, beadle of the ſame court, clerk of the city-works, printer to the city, juſtice of the Bridge-yard, clerk-comptroller of the Bridge-houſe, ſteward of the Borough, bailiff of the Borough.

There is alſo a coroner, called ſo from *corona*, i. e. a *crown*, becauſe he deals principally with the crown, or in matters appertaining to the imperial crown of England. See the article CORONER.

Beſides theſe officers, there are ſeveral courts in this city for the executing of juſtice, *viz.* the court of huſtings, lord-mayor's court, &c. In the city there are alſo two ſubordinate kinds of government. One executed by the alderman, deputy, and common-council men, and their inferior officers, in each ward; under which form are comprehended all the inhabitants, free or not free of the city. Every ward is therefore like a little free ſtate, and at the ſame time ſubject to the lord-mayor as chief magiſtrate of the city. The houſekeepers of each ward elect their repreſentatives, the common-council, who join in making bye-laws for the government of the city. The officers and ſervants of each ward manage the affairs belonging to it, without the aſſiſtance of the reſt; and each has a court called the *wardmote*, as has been already deſcribed, for the management of its own affairs. The other, by the maſter, wardens, and court of aſſiſtants, of the incorporate companies; whoſe power reaches no further than over the members of their reſpective guilds or fraternities; except that in them is inveſted the power to chooſe repreſentatives in parliament for the city, and all thoſe magiſtrates and officers elected by a common-hall; which companies are inveſted with diſtinct powers, according to the tenor of their reſpective charters.

41 Military government. The *military* government of the city is lodged in a lieutenancy, conſiſting of the lord-mayor, aldermen, and other principal citizens, who receive their authority by a commiſſion from the king. Thoſe have under their command the city trained bands, conſiſting of ſix regiments of foot, diſtinguiſhed by the names of the *white*, *orange*, *yellow*, *blue*, *green*, and *red*, each containing eight companies of 150 men, amounting in all to 7200. Beſides theſe ſix regiments, there is a corps called the *artillery company*, from its being taught the military exerciſe in the artillery-ground. This company is independent of the reſt, and conſiſts of 700 or 800 volunteers. All theſe, with two regiments of foot of 800 men each commanded by the lieutenant of the Tower of London, make the whole militia of this city; which,

London

which, exclusive of Westminster and the borough of Southwark, amounts to about 10,000 men.

42 Trading companies.

The *trading part* of the city of London is divided into 89 companies; though some of them can hardly be called so, because they have neither charters, halls, nor liveries. Of these 89 companies 55 have each a hall for transacting the business of the corporation; and this consists of a master or prime warden, a court of assistants, and livery.—Twelve of these companies are superior to the rest both in antiquity and wealth; and of one of those 12 the lord mayors have generally made themselves free at their election. These companies are the mercers, grocers, drapers, fish-mongers, goldsmiths, skinners, merchant-taylors, haberdashers, salters, iron-mongers, vintners, and clothworkers.—The principal incorporated societies of the merchants of this city are, the Hamburgh Company, the Hudson's Bay Company, the Russia Company, the Turkey Company, the East India Company, the Royal African Company, the South Sea Company, and some Insurance Companies. The most of these companies have stately houses for transacting their business, particularly the East India and South Sea companies. See COMPANY.

The streets and public buildings in London and its liberties being far too numerous for a particular description in this work, we shall only select the most remarkable, beginning with *London-Bridge* as the most ancient, and proceeding in our survey through the wards into which the city is divided.

43 Remarkable streets and buildings within the *City*.

I. *Remarkable buildings*, &c. *in the* CITY.—The original bridge, which stands in Bridge-ward, was of wood, and appears to have been first built between the years 993 and 1016; but being burnt down about the year 1136, it was rebuilt of wood in 1163. The expences, however, of maintaining and repairing it became so burdensome to the inhabitants of the city, that they resolved to build a stone-bridge a little westward of the wooden one. This building was begun in 1176, and finished in 1209; and was 915 feet long, 44 feet high, and 73 feet wide; but houses being built on each side, the space between was only 23 feet.

44 London bridge.

This great work was founded on enormous piles driven as closely as possible together: on their tops were laid long planks 10 inches thick, strongly bolted; and on them were placed the base of the pier, the lowermost stones of which were bedded in pitch, to prevent the water from damaging the work: round all were the piles which were called the *sterlings*, designed for the preservation of the foundation piles. These contracted the space between the piers so greatly, as to occasion at the retreat of every tide a fall of five feet, or a number of temporary cataracts, which since the foundation of the bridge have occasioned the loss of many thousand lives. The number of arches was 19, of unequal dimensions, and greatly deformed by the sterlings and the houses on each side, which overhung and leaned in a most terrific manner. In most places they hid the arches, and nothing appeared but the rude piers. Within recollection, frequent arches of strong timber crossed the street from the tops of the houses to keep them together, and from falling into the river (A). Nothing but use could preserve the quiet of the inmates, who soon grew deaf to the noise of the falling waters, the clamours of watermen, or the frequent shrieks of drowning wretches. In one part had been a drawbridge, useful either by way of defence or for the admission of ships into the upper part of the river. This was protected by a strong tower. It served to repulse Fauconbridge the Bastard in his general assault on the city in 1471, with a set of banditti, under pretence of rescuing the unfortunate Henry, then confined in the Tower. Sixty houses were burnt on the bridge on the occasion. It also served to check, and in the end annihilate, the ill-conducted insurrection of Sir Thomas Wyat, in the reign of Queen Mary. The top of this tower, in the sad and turbulent days of this kingdom, used to be the shambles of human flesh, and covered with heads or quarters of unfortunate partizans. Even so late as the year 1598, Hentzner, the German traveller, with German accuracy, counted on it above 30 heads. The old map of the city in 1597 represents them in a most horrible cluster.—An unparalleled calamity happened on this bridge within four years after it was finished. A fire began on it at the Southwark end; multitudes of people rushed out of London to extinguish it; while they were engaged in this charitable design, the fire seized on the opposite end, and hemmed in the crowd. Above 3000 persons perished in the flames, or were drowned by overloading the vessels which were hardy enough to attempt their relief.

The narrowness of the passage on this bridge having occasioned the loss of many lives from the number of carriages continually passing; and the straitness of the arches, with the enormous size of the sterlings, which occupied one-fourth part of the water-way, having also occasioned frequent and fatal accidents, as already mentioned; the magistrates of London in 1756 obtained an act of parliament for improving and widening the passage over and through the bridge, which granted them a toll for every carriage and horse passing over it, and for every vessel with goods passing through it: but these tolls proving insufficient, were abolished by an act made in 1758 for explaining, amending, and rendering the former act more effectual; and for granting the city of London money towards carrying on that

London.

(A) The gallant action of Edmund Osborne, ancestor to the duke of Leeds, when he was apprentice to Sir William Hewet cloth-worker, may not improperly be mentioned in this place. About the year 1536, when his master lived in one of those tremendous houses, a servant-maid was playing with his only daughter in her arms in a window over the water, and accidentally dropt the child. Young Osborne, who was witness to the misfortune, instantly sprang into the river, and, beyond all expectation, brought her safe to the terrified family! Several persons of rank paid their addresses to her when she was marriageable, among others the earl of Shrewsbury; but Sir William gratefully decided in favour of Osborne: *Osborne*, says he, *saved her, and Osborne shall enjoy her*. In her right he possessed a great fortune. He became sheriff of London in 1575, and lord-mayor in 1582.

London. that work. In conſequence of theſe acts of parliament, a temporary wooden bridge was built, and the houſes on the old bridge were taken down. Inſtead of a narrow ſtreet 23 feet wide, there is now a paſſage of 31 feet for carriages, with a raiſed pavement of ſtone on each ſide 7 feet broad for the uſe of foot paſſengers. The ſides are ſecured by ſtone baluſtrades, enlightened in the night with lamps. The paſſage thro' the bridge is enlarged by throwing the two middle arches into one, and by other alterations and improvements; notwithſtanding which, however, it is ſtill greatly ſubject to its former inconveniences.—Under the firſt, ſecond, and fourth arches, from the north ſide of the bridge, and now likewiſe towards the ſouthern extremity, there are engines worked by the flux and reflux of the river, the water of which they raiſe to ſuch a height as to ſupply many parts of the city. Thoſe engines were contrived in 1582 by one Peter Morice a Dutchman, and are called *London-bridge water works*.

45 The Monument. Near the north ſide of London bridge ſtands the *Monument*, a beautiful and magnificent fluted column of the Doric order, built with Portland ſtone, and erected in memory of the conflagration 1666. It was begun by Sir Chriſtopher Wren in 1671, and finiſhed by him in 1677. Its height from the pavement is 202 feet; the diameter of the ſhaft, or body of the column, is 15 feet; the ground-plinth, or loweſt part of the pedeſtal, is 28 feet ſquare; and the pedeſtal is 40 feet high. Over the capital is an iron balcony encompaſſing a cone 32 feet high, which ſupports a blazing urn of gilt braſs. Within is a large ſtaircaſe of black marble, containing 345 ſteps, each 10 inches and a half broad, and ſix inches thick. The weſt ſide is adorned with a curious emblem in alt-relief, denoting the deſtruction and reſtoration of the city. The firſt female figure repreſents London ſitting in ruins, in a languiſhing poſture, with her head dejected, her hair diſhevelled, and her hand careleſsly lying on her ſword. Behind is *Time*, gradually raiſing her up: at her ſide is a woman touching her with one hand, whilſt a winged ſceptre in the other directs her to regard the goddeſſes in the clouds; one with a cornucopia, denoting *Plenty;* the other with a palm branch, the emblem of *Peace*. At her feet is a bee-hive, ſhowing, that by induſtry and application the greateſt misfortunes are to be overcome. Behind the figure of *Time* are citizens exulting at his endeavours to reſtore her; and beneath, in the midſt of the ruins, is a dragon, who, as the ſupporter of the city arms, with his paw endeavours to preſerve the ſame. Oppoſite to the city, on an elevated pavement, ſtands the king, in a Roman habit, with a laurel on his head, and a truncheon in his hand; and approaching her, commands three of his attendants to deſcend to her relief. The firſt repreſents the *Sciences* with a winged head and circle of naked boys dancing thereon; and holding *Nature* in her hand, with her numerous breaſts, ready to give aſſiſtance to all. The ſecond is *Architecture*, with a plan in one hand, and ſquare and a pair of compaſſes in the other; and the third is *Liberty*, waving a hat in the air, ſhowing her joy at the pleaſing proſpect of the city's ſpeedy recovery. Behind the king ſtands his brother the duke of York, with a garland in one hand to crown the riſing city, and a ſword in the other for her defence. The two figures behind are *Juſtice* and *Fortitude;* the former with a coronet, and the latter with a reined lion; and under the royal pavement lies *Envy*, gnawing a heart, and inceſſantly emitting peſtiferous fumes from her mouth. On the plinth the reconſtruction of the city is repreſented by builders and labourers at work upon houſes. On the north, ſouth, and eaſt ſides, are inſcriptions relating to the deſtruction occaſioned by the conflagration, the regulations about rebuilding the city, and erecting the monument; and round it is the following one:—"This pillar was ſet up in perpetual remembrance of the moſt dreadful burning of this Proteſtant city, begun and carried on by the treachery and malice of the Popiſh faction, in the beginning of September, in the year of our Lord 1666, in order to their carrying on their horrid plot for extirpating the Proteſtant religion and *old Engliſh* liberty, and introducing Popery and ſlavery." Dr Wendeborn, in his account of London, obſerves, that the monument, though not much above 100 years old, bears viſible marks of decay already; and it will not probably be long before it muſt be pulled down. Some are of opinion that this is occaſioned by the fault of the architect, others by the continual ſhaking of the ground by coaches; but the Doctor inclines to the latter opinion.

46 The Tower. Eaſtward of the bridge and monument ſtands the *Tower*, which gives name to another ward. It is the chief fortreſs of the city, and ſuppoſed to have been originally built by William the Conqueror. It appears, however, to have been raiſed upon the remains of a more ancient fortreſs, erected probably by the Romans: for in 1720, in digging on the ſouth ſide of what is called *Cæſar's Chapel*, there were diſcovered ſome old foundations of ſtone, three yards broad, and ſo ſtrongly cemented that it was with the utmoſt difficulty they were forced up. The firſt work (according to Mr Pennant) ſeems to have been ſuddenly flung up in 1066 by the Conqueror, on his taking poſſeſſion of the capital; and included in it a part of the ancient wall.

The great ſquare tower, called the *White Tower*, was erected in the year 1078, when it aroſe under the directions of Gundulph biſhop of Rocheſter, who was a great military architect. This building originally ſtood by itſelf. Fitzſtephen gives it the name of *Arx Palatina*, "the Palatine Tower;" the commander of which had the title of Palatine beſtowed on him. Within this tower is a very ancient chapel for the uſe of ſuch of our kings and queens who wiſhed to pay their devotion here. In 1092 a violent tempeſt did great injury to the Tower; but it was repaired by William Rufus and his ſucceſſor. The firſt added another caſtellated building on the ſouth ſide between it and the Thames, which was afterwards called *St Thomas's Tower*.

The Tower was firſt incloſed by William Longchamp, biſhop of Ely and chancellor of England, in the reign of Richard I. This haughty prelate having a quarrel with John, third brother to Richard, under pretence of guarding againſt his deſigns, ſurrounded the whole with walls embattled, and made on the outſide a vaſt ditch, into which, in after times, the water from the Thames was introduced. Different princes added other works. The preſent contents within the walls

London. walls are 12 acres and 5 rods, the circuit on the outside of the ditch 1052 feet. It was again incloſed with a mud-wall by Henry III. this was placed at a diſtance from the ditch, and occaſioned the taking down part of the city-wall, which was reſented by the citizens; who, pulling down this precinct of mud, were puniſhed by the king with a fine of a thouſand merks.

The *Lions Tower* was built by Edward IV. it was originally called the *Bulwark*, but received the former name from its uſe. A menagery had very long been a piece of regal ſtate: Henry I. had his at his manor of Woodſtock, where he kept lions, leopards, lynxes, porcupines, and ſeveral other uncommon beaſts. They were afterwards removed to the Tower. Edward II. commanded the ſheriffs of London to pay the keepers of the king's leopards ſixpence a day for the ſuſtenance of the leopards, and three halfpence a day for the diet of the keeper out of the fee-farm of the city. The royal menagery is to this day exceedingly well ſupplied.

In 1758 the Tower-ditch was railed all round. New barracks were ſome years ago erected on the Tower-wharf, which parts it from the river; and upon the wharf is a line of 61 pieces of cannon, which are fired upon ſtate holidays. On this ſide of the Tower the ditch is narrow, and over it is a draw-bridge. Parallel to the wharf, within the walls, is a platform 70 yards in length, called the *Ladies Line*, becauſe much frequented by the ladies in the ſummer; it being ſhaded in the inſide with a row of lofty trees, and without it is a delightful proſpect of the ſhipping with boats paſſing and repaſſing on the river Thames. You aſcend this line by ſtone ſteps, and being once upon it you may walk almoſt round the walls of the Tower without interruption. London.

The principal entrance into the Tower is by a gate to the weſt, large enough to admit coaches and heavy carriages; but theſe are firſt admitted through an outward gate, ſituated without the ditch upon the hill, and muſt paſs a ſtout ſtone-bridge built over the ditch before they can approach the main entrance. There is, beſides, an entrance near the very ſouth-weſt corner of the Tower outward wall, for perſons on foot, over the draw-bridge already mentioned to the wharf. There is alſo a water-gate, commonly called *Traitor's gate*, through which it has been cuſtomary to convey traitors and other ſtate-priſoners to or from the Tower, and which is ſeldom opened on any other occaſion; but the lords committed to the Tower in 1746 were publicly admitted at the main entrance. Over this gate is a regular building, terminated at each end by two round towers, on which are embraſures for pointing cannon. In this building there are the infirmary, the mill, and the water-works that ſupply the Tower with water.

In the Tower (the curioſities of which are more particularly deſcribed in the note (B)), are a church, the

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(B) In examining the curioſities of the Tower of London, it will be proper to begin with thoſe on the outſide of the principal gate. The firſt thing a ſtranger uſually goes to viſit is the wild beaſts; which, from their ſituation, firſt preſent themſelves: for having entered the outer gate, and paſſed what is called the ſpur-guard, the keeper's houſe preſents itſelf before you, which is known by a painted lion on the wall, and another over the door which leads to their dens. By ringing a bell, and paying ſixpence each perſon, you may eaſily gain admittance.

The next place worthy of obſervation is the Mint, which comprehends near one-third of the Tower, and contains houſes for all the officers belonging to the coinage. On paſſing the principal gate you ſee the White Tower, built by William the Conqueror. This is a large, ſquare, irregular ſtone building, ſituated almoſt in the centre, no one ſide anſwering to another, nor any of its watch-towers, of which there are four at the top, built alike. One of theſe towers is now converted into an obſervatory. In the firſt ſtory are two noble rooms, one of which is a ſmall armoury for the ſea-ſervice, it having various ſorts of arms, very curiouſly laid up, for above 10,000 ſeamen. In the other room are many cloſets and preſſes, all filled with warlike engines and inſtruments of death. Over this are two other floors, one principally filled with arms; the other with arms and other warlike inſtruments, as ſpades, ſhovels, pick-axes, and chevaux de frize. In the upper ſtory are kept match, ſheep-ſkins, tanned hides, &c. and in a little room called Julius Cæſar's chapel, are depoſited ſome records, containing perhaps the ancient uſages and cuſtoms of the place. In this building are alſo preſerved the models of the new-invented engines of deſtruction that have from time to time been preſented to the government. Near the ſouth-weſt angle of the White Tower is the Spaniſh armoury, in which are depoſited the ſpoils of what was vainly called the Invincible Armada; in order to perpetuate to lateſt poſterity the memory of that ſignal victory obtained by the Engliſh over the whole naval power of Spain in the reign of Philip II.

You are now come to the grand ſtore-houſe, a noble building to the northward of the White Tower, that extends 245 feet in length and 60 in breadth. It was begun by king James II. who built it to the firſt floor; but it was finiſhed by king William III. who erected that magnificent room called the New or Small Armoury, in which that prince, with queen Mary his conſort, dined in great form, having all the warrant workmen and labourers to attend them, dreſſed in white gloves and aprons, the uſual badges of the order of maſonry. To this noble room you are led by a folding door, adjoining to the eaſt end of the Tower chapel, which leads to a grand ſtair-caſe of 50 eaſy ſteps. On the left ſide of the uppermoſt landing-place is the work-ſhop, in which are conſtantly employed about 14 furbiſhers, in cleaning, repairing, and new-placing the arms. On entering the armoury, you ſee what they call a wilderneſs of arms, ſo artfully diſpoſed, that at one view you behold arms for near 80,000 men, all bright, and fit for ſervice; a ſight which it is impoſſible to behold without aſtoniſhment; and beſide thoſe expoſed to view, there were, before the late war, 16 cheſts

 ſhut

London. the offices of ordnance and of the mint, thoſe of the keepers of the records, of the jewel-office, of the Spaniſh armoury, the horſe armoury, and the new or ſmall armoury; with barracks for the ſoldiers of the garriſon, and handſome houſes for ſeveral officers who reſide here. The principal officers of the Tower are, a conſtable, a lieutenant, and a deputy-lieutenant. Belonging to this fortreſs are eleven hamlets; the militia of which, conſiſting of 400 men, are obliged, at the command of the conſtable of the Tower, to repair hither, and reinforce the garriſon. London.

On Little Tower-hill is the *Victualling-office* for the navy. 47 Victualling Office.

ſhut up, each cheſt holding about 1000 muſkets. The arms were originally diſpoſed by Mr Harris, who contrived to place them in this beautiful order, both here and in the guard chamber of Hampton-court. He was a common gunſmith; but after he had performed this work, which is the admiration of people of all nations, he was allowed a penſion from the crown for his ingenuity.

Upon the ground floor, under the ſmall armoury, is a large room of equal dimenſions with that, ſupported by 20 pillars, all hung round with implements of war. This room, which is 24 feet high, has a paſſage in the middle 16 feet wide. At the ſight of ſuch a variety of the moſt dreadful engines of deſtruction, before whoſe thunder the moſt ſuperb edifices, the nobleſt works of art, and numbers of the human ſpecies, fall together in one common and undiſtinguiſhed ruin; one cannot help wiſhing that thoſe horrible inventions had ſtill lain, like a falſe conception, in the womb of nature, never to have been ripened into birth.

The horſe armoury is a plain brick-building, a little to the eaſtward of the White Tower; and is an edifice rather convenient than elegant, where the ſpectator is entertained with a repreſentation of thoſe kings and heroes of our own nation, with whoſe gallant actions it is to be ſuppoſed he is well acquainted; ſome of them equipped and ſitting on horſeback, in the ſame bright and ſhining armour they were uſed to wear when they performed thoſe glorious actions which gave them a diſtinguiſhed place in the Britiſh annals.

You now come to the line of kings, which your conductor begins by reverſing the order of chronology; ſo that in following them we muſt place the laſt firſt.

In a dark, ſtrong ſtone room, about 20 yards to the eaſtward of the grand ſtorehouſe, or new armoury, the crown jewels are depoſited. 1. The imperial crown, with which it is pretended that all the kings of England have been crowned ſince Edward the Confeſſor in 1040. It is of gold, enriched with diamonds, rubies, emeralds, ſapphires, and pearls: the cap within is of purple velvet, lined with white taffety, turned up with three rows of ermine. They are, however, miſtaken in ſhowing this as the ancient imperial diadem of St Edward: for that, with the other moſt ancient regalia of this kingdom, was kept in the arched room in the cloiſters in Weſtminſter Abbey till the civil war; when, in 1642, Harry Martin, by order of the parliament, broke open the iron cheſt in which it was ſecured, took it thence, and ſold it, together with the robes, ſword, and ſceptre, of St Edward. However, after the Reſtoration, king Charles II. had one made in imitation of it, which is that now ſhown. 2. The golden orb, or globe, put into the king's right hand before he is crowned; and borne in his left hand, with the ſceptre in his right, upon his return into Weſtminſter-hall after he is crowned. It is about ſix inches in diameter, edged with pearl, and enriched with precious ſtones. On the top is an amethyſt, of a violet colour, near an inch and an half in height, ſet with a rich croſs of gold, adorned with diamonds, pearls, and precious ſtones. The whole height of the ball and cup is 11 inches. 3. The golden ſceptre, with its croſs ſet upon a large amethyſt of great value, garniſhed round with table diamonds. The handle of the ſceptre is plain, but the pummel is ſet round with rubies, emeralds, and ſmall diamonds. The top riſes into a *fleur de lis* of ſix leaves, all enriched with precious ſtones, from whence iſſues a mound or ball, made of the amethyſt already mentioned. The croſs is quite covered with precious ſtones. 4. The ſceptre, with the dove, the emblem of peace, perched on the top of a ſmall Jeruſalem croſs, finely ornamented with table diamonds and jewels of great value. This emblem was firſt uſed by Edward the Confeſſor, as appears by his ſeal; but the ancient ſceptre and dove was ſold with the reſt of the regalia, and this now in the Tower was made after the Reſtoration. 5. St Edward's ſtaff, four feet ſeven inches and an half in length, and three inches three quarters in circumference, all of beaten gold, which is carried before the king at his coronation. 6. The rich crown of ſtate, worn by his majeſty in parliament; in which is a large emerald ſeven inches round; a pearl eſteemed the fineſt in the world; and a ruby of ineſtimable value. 7. The crown belonging to his royal highneſs the prince of Wales. The king wears his crown on his head when he ſits upon the throne; but that of the prince of Wales is placed before him, to ſhow that he is not yet come to it. 8. The late queen Mary's crown, globe, and ſceptre, with the diadem ſhe wore at her coronation with her conſort king William III. 9. An ivory ſceptre, with a dove on the top, made for king James II.'s queen, whoſe garniture is gold, and the dove on the top gold enamelled with white. 10. The *curtana*, or ſword of mercy, which has a blade of 32 inches long, and near two broad, is without a point, and is borne naked before the king at his coronation, between the two ſwords of juſtice, ſpiritual and temporal. 11. The golden ſpurs, and the armillas, which are bracelets for the wriſts. Theſe, though very antique, are worn at the coronation. 12. The *ampulla*, or eagle of gold, finely engraved, which holds the holy oil the kings and queens of England are anointed with; and the golden ſpoon that the biſhop pours the oil into. Theſe are two pieces of great antiquity. The golden eagle, including the pedeſtal, is about nine inches high, and the wings expand about ſeven inches. The whole weighs about ten ounces. The head of the eagle ſcrews off about the middle of the neck, which is made hollow, for holding the holy oil; and when the king is anointed by the biſhop, the oil is poured into the ſpoon out of the bird's bill. 13. A rich

ſaltſeller

London. navy. It is separated from Tower-hill by a wall and gate, and contains houſes for the officers, ſlaughter-houſes, ſtore-rooms, a brew-houſe, a ſalting-houſe, and a barrelling-houſe; under the direction of ſeven commiſſioners and other inferior officers.

48 Cuſtom-houſe. In Tower ward is alſo the *Cuſtom houſe*, a large, handſome, and commodious building of brick and ſtone. It ſtands upon the bank of the Thames, and is accommodated with large wharfs, keys, and ware-houſes. On this ſpot is the buſy concourſe of all nations, who pay their tribute towards the ſupport of Great Britain. About the year 1559, the loſs to the revenue, by collecting it in different parts of the city, was firſt diſcovered, and an act paſſed to compel people to land their goods in ſuch places as were appointed by the commiſſioners of the revenue; and this was the ſpot fixed on: A cuſtom-houſe was erected; which, being deſtroyed by the great fire, was rebuilt by Charles II. In 1718 it underwent the ſame fate, and was reſtored in its preſent form. Before the cuſtom-houſe was eſtabliſhed here, the principal place for receiving the duties was at Billingſgate. In 1268 the half year's cuſtoms for foreign merchandiſe in the city of London came only to L.75:6:10; the annual produce of the cuſtoms, ending in April 1789, amounted to L.3,711,126.

49 Trinity Houſe. In Water-lane, a little to the north-weſt of the cuſtom-houſe, is the *Trinity-houſe*; a ſociety founded in 1515, at a period in which the Britiſh navy began to aſſume a ſyſtem. The founder was Sir Thomas Spert comptroller of the navy, and commander of the great ſhip Henry Grace de Dieu. It is a corporation, conſiſting of a maſter, four wardens, eight aſſiſtants, and eighteen elder brethren; ſelected from commanders in the navy and the merchants ſervice; and now and then a compliment is paid to one or two of our firſt nobility. They may be conſidered as guardians of our ſhips, military and commercial. Their powers are very extenſive: they examine the mathematical children of Chriſt's hoſpital, and the maſters of his majeſty's ſhips; they appoint pilots for the river Thames; ſettle the general rates of pilotage; erect light-houſes and ſea-marks; grant licences to poor ſeamen, not free of the city, to row on the Thames; prevent foreigners from ſerving on board our ſhips without licence; puniſh ſeamen for mutiny and deſertion; hear and determine complaints of officers and men in the merchants ſervice, but liable to appeal to the judge of the court of admiralty, ſuperintend the deepening and cleanſing of the river Thames, and have under their juriſdiction the ballaſt-office; have powers to buy lands, and receive donations for charitable uſes; and, in conſequence, relieve annually many thouſands of poor ſeamen, their widows, and orphans. It is in this houſe the buſineſs of the inſtitution is carried on: but the mother-houſe is at Deptford, the corporation being named, "the maſter, wardens, and aſſiſtants of the guild or fraternity of the moſt glorious and undivided Trinity, and of St Clement, in the pariſh of Deptford Strond, in the county of Kent." London.

50 The Minories. Between Aldgate and the Tower is the ſtreet called the *Minories*, from ſome poor ladies of the order of St Clare, or minoreſſes. They had been invited to London by Blanch queen of Navarre, and wife to Edmund earl of Lancaſter, who founded a convent for them in 1293. On the ſuppreſſion of the monaſteries it was converted into a dwelling-houſe for ſome of the nobility, and is now in the poſſeſſion of the Dartmouth family. Till of late years, the Minories were but a deſpicable ſtreet; but have now been excellently rebuilt, and are as elegant as any in the city.

On the weſt ſide of the city-walls at this place, ſtood the houſe of the *Crutched* or *Croſſed Friars*, an order inſtituted at Bologna in 1169, and of which a branch ſettled in England in 1244, where they were accommodated with an houſe in this place by two citizens named *Ralph Hoſier* and *William Sabernas*, who became members

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ſaltſeller of ſtate, in form like the ſquare White Tower, and ſo exquiſitely wrought, that the workmanſhip of modern times is in no degree equal to it. It is of gold, and uſed only on the king's table at the coronation. 14. A noble ſilver font, double gilt, and elegantly wrought, in which the royal family are chriſtened. 15. A large ſilver fountain, preſented to king Charles II. by the town of Plymouth, very curiouſly wrought; but much inferior in beauty to the above. Beſides theſe, which are commonly ſhown, there are in the jewel office all the crown jewels worn by the princes and princeſſes at coronations, and a great variety of curious old plate.

The record office conſiſts of three rooms, one above another, and a large round room, where the rolls are kept. Theſe are all handſomely wainſcotted, the wainſcot being framed into preſſes round each room, within which are ſhelves and repoſitories for the records; and for the eaſier finding of them, the year of each reign is inſcribed on the inſide of theſe preſſes, and the records placed accordingly. Within theſe preſſes, which amount to 56 in number, are depoſited all the rolls, from the firſt year of the reign of king John to the beginning of the reign of Richard III. but thoſe after this laſt period are kept in the Rolls Chapel. The records in the Tower, among other things, contain the foundation of abbeys and other religious houſes; the ancient tenures of all the lands in England, with a ſurvey of the manors; the original of laws and ſtatutes; proceedings of the courts of common law and equity; the rights of England to the dominion of the Britiſh ſeas; leagues and treaties with foreign princes; the atchievements of England in foreign wars; the ſettlement of Ireland, as to law and dominion; the forms of ſubmiſſion of ſome Scottiſh kings for territories held in England; ancient grants of our kings to their ſubjects; privileges and immunities granted to cities and corporations during the period above mentioned; inrolments of charters and deeds made before the Conqueſt; the bounds of all the foreſts in England, with the ſeveral reſpective rights of the inhabitants to common paſture, and many other important records, all regularly diſpoſed, and referred to in near a thouſand folio indexes. This office is kept open, and attendance conſtantly given, from ſeven o'clock till one, except in the months of December, January, and February, when it is open only from eight to one, Sundays and holidays excepted. A ſearch here is half a guinea, for which you may peruſe any one ſubject a year.

London. members of their order. Henry VIII. granted their houſe to Sir Whomas Wyatt the elder, who built a handſome manſion on part of the ground where it ſtood. This manſion became afterwards the reſidence of John Lord Lumley, a celebrated warrior in the time of Henry VIII. In proceſs of time, it was converted into a navy-office: but this office being removed to Somerſet-houſe, the India Company have erected in its place a moſt magnificent warehouſe, in form of an oblong ſquare of about 250 feet by 160, incloſing a court of 150 by 60 feet, the entrance to which is by an arched gateway.

51 India Company's warehouſes.

52 Billingſgate Billingſgate ward is diſtinguiſhed by its *market*. *Billingſgate* was a ſmall port for the reception of ſhipping, and for a conſiderable time the moſt important place for the landing of almoſt every article of commerce. In the time of King William, Billingſgate began to be celebrated as a fiſh-market. In 1699 it was by act of parliament made a free port for fiſh to be ſold there every day except Sunday; but Mr Pennant informs us, that the object of this has long been fruſtrated, and that fiſh are now no longer to be had there in perfection. The ſame author gives a liſt of the fiſh which in the time of Edward III. were brought to the London market; the monarch himſelf having condeſcended to regulate the prices, that his ſubjects might not be impoſed upon by thoſe who ſold them. Among theſe were the conger-eel and porpoiſe, neither of which is now admitted to any table. A pike at that time coſt 6s. 8d.; whence our author concludes, that it was an exotic fiſh, and brought over at a vaſt expence. Some fiſhes are mentioned in his liſt with which this naturaliſt owns himſelf unacquainted, *viz.* the *barkey*, *bran*, *batrile*, *cropling*, and *rumb*. In Archbiſhop Nevill's great feaſt is mentioned alſo a fiſh named *thirle-poole*, unknown at preſent. Seals were formerly accounted a fiſh; and theſe, together with the ſturgeon and porpoiſe, were the only freſh fiſh permitted by the 33d of Henry VIII. to be bought of any ſtranger at ſea between England, France, Flanders, and Zealand.

53 Leadenhall. Limeſtreet ward is remarkable for a very large building, of great antiquity, called *Leadenhall*, with flat battlements leaded on the top, and a ſpacious ſquare in the middle. In 1309 it was the houſe of Sir Hugh Nevil knight; in 1384, of Humphry Bohun Earl of Hereford; in 1408 it became the property of the celebrated Whittington, who preſented it to the mayor and commonalty of London; and in 1419, a public granary was erected here by Sir Simon Eyre, a citizen and draper, who built it with ſtone in its preſent form. This granary was deſigned as a preſervative againſt famine, and to be kept always full of corn which deſign was for ſome time happily anſwered. The houſe came to be uſed for many other purpoſes beſides that of a granary; as for keeping the artillery and arms of the city. Preparations for any kind of pageantry or triumph were alſo made here; and from its ſtrength the place was conſidered as the chief fortreſs within the city in caſe of any popular inſurrection, and was likewiſe the place from whence alms were diſtributed. In this edifice are warehouſes for the ſale of leather, Colcheſter baize, meal, and wool. Adjoining to Leadenhall is a market, thence called *Leadenhall market*, conſiſting of five conſiderable ſquares or courts, and reckoned one of the greateſt markets in Europe for fleſh and other proviſions, as well as for leather, green hides, and wool. A little to the eaſtward is the *India-houſe*, built in 1726, on the ſpot occupied by Sir William Craven, mayor in 1610. According to Mr Pennant, this houſe "is not worthy of the lords of Indoſtan."

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54 The India-Houſe.

In Broadſtreet is the *Bank of England*, a ſtone building, which occupies one ſide of Three-needle ſtreet. The centre, and the building behind, were founded in the year 1733; the architect George Sampſon. Before that time the buſineſs was tranſacted in Grocers-hall. The front is a ſort of veſtibule; the baſe ruſtic, the ornamental columns above Ionic. Within is a court leading to a ſecond elegant building, which contains a hall and offices, where the debt of above 250 millions is punctually diſcharged. Of late years two wings of uncommon elegance, deſigned by Sir Robert Taylor, have been added, at the expence of a few houſes, and of the church of St Chriſtopher's le Stocks. "The name of the projector of this national glory (ſays Mr Pennant), was Mr James Paterſon of Scotland. This palladium of our country was in 1780 ſaved from the fury of an infamous banditti by the virtue of its citizens, who formed ſuddenly a volunteer company, and over-awed the miſcreants; while the chief magiſtrate ſkulked, trembling in his manſion-houſe, and left his important charge to its fate. This important building has ever ſince been very properly guarded by the military; who, in paſſing through the city, have often given offence to many buſy characters who would ſtrive to preſerve the city rights at the expence of the national deſtruction. A lord mayor was the laſt who intereſted himſelf by applying to Mr Grenville, who gave him to underſtand, that if the guards were not quietly permitted to diſcharge their duty, the bank would be removed to Somerſet-houſe."

55 Bank of England.

At the extremity of Three-needle ſtreet is *Merchant-Taylors Hall*. In this ſtreet alſo is the *South-Sea Houſe*, firſt eſtabliſhed in 1711 for the purpoſe of an excluſive trade to the South Sea, and for ſupplying Spaniſh America with negroes.

56 Merchant-Taylors Hall, &c.

Near the junction of Throgmorton ſtreet with Broad-ſtreet ſtood a magnificent houſe built by Cromwell earl of Eſſex; after whoſe fall, the houſe and gardens were bought by the Drapers company. The houſe was deſtroyed in the great fire, but rebuilt for the uſe of the company in a magnificent manner.

57 St Giles's.

Mr Pennant informs us, that *St Giles's church* in the fields, and a few houſes to the weſt of it, in the year 1600, was barely ſeparated from Broad-ſtreet. The church is ſuppoſed to have belonged to an hoſpital for lepers, founded about the year 1117, by Matilda queen to Henry I. In ancient times it was cuſtomary here to preſent to malefactors, on their way to the gallows (which, about the year 1413, was removed from Smithfield, and placed between St Giles's high-ſtreet and Hog-lane (c), a great bowl of ale, as the laſt refreſhment they were to receive in this life. On

(c) This late place of execution, according to Mr Pennant, was called in the time of Edward III. when the

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the door to the church-yard is a curious piece of ſculpture, repreſenting the laſt day, containing an amazing number of figures, ſet up about the year 1686. This church was rebuilt in 1625. By the amazing raiſing of the ground by filth and various adventitious matter, the floor in the year 1730 was eight feet below the ſurface acquired in the intervening time. This alone made it neceſſary to rebuild the church in the preſent century. The firſt ſtone was laid in 1730; it was finiſhed in 1734, at the expence of 10,000l.—In the church-yard is a great ſquare pit, with many rows of coffins piled one upon the other, all expoſed to ſight and ſmell, the latter of which is highly offenſive if not dangerous.

On the weſt ſide of Broad-ſtreet ſtood the houſe of the Auguſtines, founded by Humphrey Bohun Earl of Somerſet in 1253, for friars and hermits of the Auguſtine order. On the diſſolution of the monaſteries, great part of the houſe was granted to William Lord St John, afterwards Marquis of Winchеſter, and Lord Treaſurer, who founded a magnificent houſe named *Wincheſter-houſe*. The weſt end of the church was granted in 1551 to John a Laſco for the uſe of the Germans and other fugitive Proteſtants, and afterwards to the Dutch as a place for preaching. A part of it was alſo converted into a glaſs-houſe for Venice glaſs, in which the manufacture was carried on by artiſts from that city, and patroniſed by the Duke of Buckingham. The place was afterwards converted into *Pinners-hall*, belonging to the company of pin-makers.

58 Wincheſter Houſe.

To the eaſtward of Wincheſter-ſtreet ſtood the houſe of that very eminent merchant Sir Thomas Greſhham, afterwards known by the name of *Greſham college*: (See GRESHAM.) It has been pulled down not many years ago; and the *Exciſe Office*, a moſt magnificent and at the ſame time ſimple building, roſe in its place. Mr Pennant informs us, that from the 5th of January 1786 to January 5th 1787, the payments into this office amounted to no leſs than L. 5,531,114 : 6 : 10½.

59 Greſham College.

60 Exciſe-Office.

61 Royal Exchange.

The *Royal Exchange*, which is the meeting-place of the merchants of London, ſtands in the ward of Cornhill, and is the fineſt and ſtrongeſt fabric of the kind in Europe. It was founded in the year 1566. Sir Thomas Greſham, merchant in London, made an offer to the lord mayor and citizens, to build, at his own expence, a commodious edifice for merchants to meet and tranſact buſineſs, provided the city would find him a convenient ſituation for the ſame. Mr Pennant informs us, that one Richard Clough a Welſhman, originally Sir Thomas's ſervant, firſt put him on this deſign by a letter from Antwerp, in which he reproached the London merchants with having no place to tranſact their buſineſs, but walking about in the rain, more like pedlars than merchants. The citizens, in compliance with Sir Thomas's deſire, purchaſed, for the ſum of L. 3532, 80 houſes in the two alleys called *New St Chriſtopher's*, and *Swan-alley*, leading out of Cornhill into Three-needle ſtreet. The materials of thoſe houſes were ſold for L. 478, and the ground, when cleared, was conveyed to Sir Thomas Greſham, who, accompanied by ſeveral aldermen, laid the firſt brick of the new building on the 7th of June that year. Each alderman alſo laid his brick, and left a piece of gold for the workmen; who ſet about it with ſuch aſſiduity and reſolution, that the whole fabric was roofed by the month of November 1567, and was ſoon after completed under the name of the *Burſe*. This building was totally deſtroyed by the fire in 1666; and in its place the preſent magnificent ſtructure was erected at the expence of L. 80,000, which ſtands upon a plat of ground 203 feet in length and 171 in breadth, containing an area in the middle, of 61 ſquare perches, ſurrounded with a ſubſtantial and regular ſtone building, wrought in ruſtic. It has two fronts, north and ſouth, each of which is a piazza; and in the centre are the grand entrances into the area, under a very lofty and noble arch. The ſouth front in Cornhill is the principal; on each ſide of which are Corinthian demi-columns, ſupporting a compaſs pediment; and, in the intercolumniation on each ſide, in the front next the ſtreet, is a niche, with the ſtatues of King Charles I. and II. in Roman habits, and well executed. Over the aperture, on the cornice between the two pediments, are the king's arms in relievo: on each ſide of this entrance is a range of windows placed between demi-columns, and pilaſters of the compoſite order, above which runs a baluſtrade. This building is 56 feet high: and from the centre, in this front, riſes a lanthorn and turret 178 feet high, on the top of which is a fane of gilt braſs made in the ſhape of a graſshopper, the creſt of Sir Thomas Greſham's arms. The north front in Three-needle-ſtreet is adorned with pilaſters of the compoſite order; but has neither columns nor ſtatues on the outſide; and has triangular, inſtead of compaſs, pediments. The inſide of the area is alſo ſurrounded with piazzas, forming ambulatories for merchants, &c. to ſhelter themſelves from the weather, when met there upon buſineſs. Above the arches of this piazza is an entablature with curious ornaments; and on the cornice a range of pilaſters with an entablature extending round, and a compaſs pediment in the middle of the cornice of each of the four ſides. Under the pediment on the north ſide are the king's arms; and the ſouth, the city's arms; on the eaſt, Sir Thomas Greſham's arms; and on the weſt, the mercer's arms, with their reſpective enrichments. In theſe intercolumns are 24 niches, 20 of which are filled with the ſtatues of the kings and queens of England.

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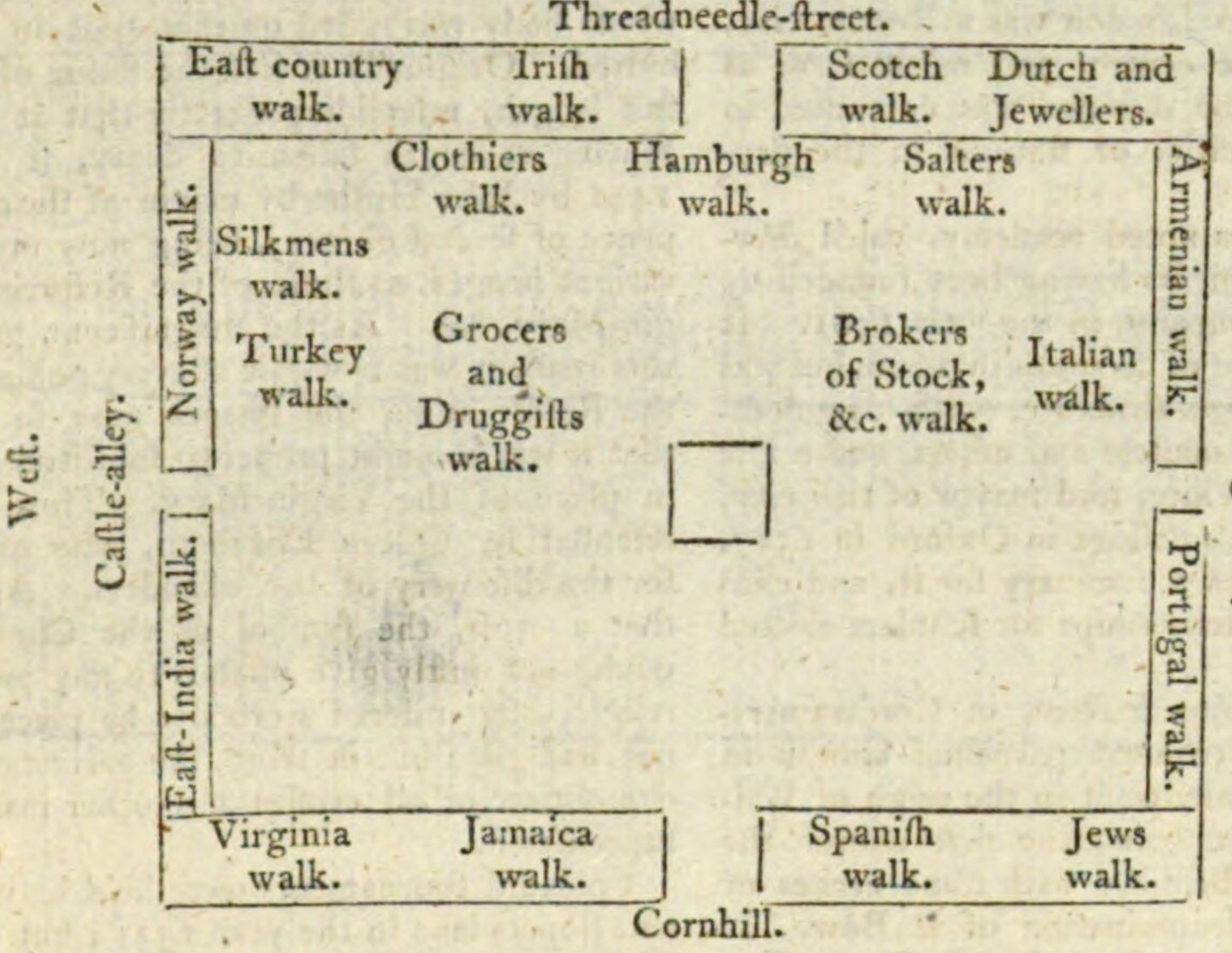
the gentle Mortimer finiſhed his days here, *the Elms*: but the original as well as the preſent name was *Tybourne*; not from *tye* and *burn*, as if it were called ſo from the manner of capital puniſhments; but from *bourne*, the Saxon word for a "brook," and *Tye* the name of that brook, which joined gave name to a manor before the conqueſt. Here was alſo a village and church denominated *St John the Evangeliſt*, which fell to decay, and was ſucceeded by that of *Mary bourne*, corrupted into *Mary-la-bonne*. In 1626, Queen Henrietta Maria was compelled by her prieſts to take a walk by way of penance to Tyburn. What her offence was we are not told; but Charles was ſo diſguſted at this inſolence, that he ſoon after ſent them and all her majeſty's French ſervants out of the kingdom.

London. land. Under theſe piazzas, within the area, are 28 niches, all vacant but that in which Sir Thomas Greſham's ſtatue is placed in the north-weſt angle, and that in the ſouth-weſt, where the ſtatue of Sir John Barnard was placed in his lifetime by his fellow-citizens to expreſs their ſenſe of his merit. The centre of this area alſo is ornamented with a ſtatue of King Charles II. in a Roman habit, ſtanding upon a marble pedeſtal about eight feet high, and encompaſſed with iron rails; which pedeſtal is enriched on the ſouth ſide with an imperial crown, a ſceptre, ſword, palm-branches, and other decorations, with a very flattering inſcription to the king. On the weſt ſide is a cupid cut in relievo, reſting his right hand on a ſhield with the arms of France and England quartered, and holding a roſe in his left hand. On the north ſide is another cupid ſupporting a ſhield with the arms of Ireland; and on the eaſt ſide are the arms of Scotland, with a cupid holding a thiſtle; all done in relievo: the whole executed by that able ſtatuary Mr Gibbon. London.

In this area, merchants, and ſuch as have buſineſs with them, meet every day at change hours; and for the more regular and readier diſpatch of buſineſs, they diſpoſe of themſelves into ſeparate walks, according to the following plan.



In building this expenſive ſtructure there was an eye not only to magnificence, and to accommodate the merchants, but alſo to reimburſe the expence. For this reaſon a gallery was built over the four ſides of the royal exchange. This was divided into 200 ſhops, which were let out to haberdaſhers, milliners, &c. and which for ſeveral years were well occupied. But theſe ſhops have now for a long time been deſerted, and the galleries are let out to the Royal Exchange Aſſurance-office, the Merchant-ſeamens office, the Marine Society, and to auctioneers, &c. Under the whole area there are the fineſt dry vaults that can be found any where, which are let out to the Eaſt India company to depoſit their pepper. In the turret is a good clock with four dials, which is well regulated ever day, ſo that it becomes a ſtandard of time to all the mercantile part of the town; and it goes with chimes at three, ſix, nine, and twelve o'clock, playing upon twelve bells. The outſide of this grand fabric ſuffers very much in its elegance from the ſhops that ſurround it, and are built within its walls; and which are occupied by bookſellers, toymen, cutlers, hoſiers, watch-makers, &c.

62 General Poſt-Office.

South of the Royal-exchange, and near the weſt extremity of Lombard-ſtreet, is the *General Poſt Office*, which is a handſome and commodious building.

63 The Manſion-houſe.

In Walbrook ward is the *Manſion-houſe*, for the reſidence of the lord-mayor. This edifice was begun in 1739, and finiſhed in 1753. It is built of Portland ſtone, with a portico of ſix fluted columns, of the Corinthian order, in the front. The baſement ſtory is very maſſy, and conſiſts of ruſtic work; in the centre of it is the door, which leads to the kitchens, cellars, and other offices. On each ſide riſes a flight of ſteps, leading up to the portico, in the middle of which is the principal entry. The ſtone baluſtrade of the ſtairs is continued along the front of the portico, and the columns ſupport a large angular pediment, adorned with a group of figures in bas relief, repreſenting the dignity and opulence of the city of London. It is an extreme heavy building, of an oblong form, and its depth is the long ſide, having ſeveral magnificent apartments, which are not, however, well lighted, on account of the houſes that ſurround it.

64 St Stephen's Church.

Behind the manſion-houſe is *St Stephen's church*, in Walbrook, juſtly reputed the maſter-piece of the celebrated Sir Chriſtopher Wren, and is ſaid to exceed every modern ſtructure in the world in proportion and elegance.

The manſion-houſe, and many adjacent buildings, ſtand on the place where the *Stocks market* once ſtood. This took its name from a pair of ſtocks erected

London. ted near the ſpot in 1281; and was the great market of London for proviſions during many centuries.

65 London-ſtone. In this ward is ſituated one of the moſt remarkable pieces of antiquity in London. It is a great ſtone, now ſtanding in a caſe on the north ſide of Canon-ſtreet, cloſe under the ſouth wall of St Swithin's church. It is called *London-ſtone;* and was formerly pitched edgeways on the other ſide of the ſtreet, oppoſite to where it now ſtands, fixed deeply in the ground, and ſtrongly faſtened with iron bars; but for the conveniency of wheel-carriages it was removed to its preſent ſituation. This ſtone is mentioned ſo early as the time of Athelſtan, king of the Weſt Saxons, and has been carefully preſerved from age to age. Of the original cauſe of its erection no memorial remains; but it is conjectured, that as London was a Roman city, this ſtone might be the centre, and might ſerve as an object from which the diſtance was computed to the other conſiderable cities or ſtations in the province.

66 Merchant-Taylors School. In Dowgate ward is a noted academy, caled *Merchant-taylors School*, from its having been founded by the merchant-taylors company, in the year 1561. It was deſtroyed by the fire of London in 1666, but was rebuilt, and is a very large ſtructure, with commodious apartments for the maſters and uſhers, and a fine library. Sir Thomas White, lord mayor of this city, having founded St John's college in Oxford in 1557, appointed this ſchool as a ſeminary for it, and eſtabliſhed at Oxford 46 fellowſhips for ſcholars elected from this ſchool.

67 St Mary le Bow. The church of *St Mary le Bow*, in Cordwainers-ſtreet ward, is the moſt eminent parochial church in the city. It was originally built in the reign of William the Conqueror; and being the firſt church the ſteeple of which was embelliſhed with ſtone arches or bows, took thence its denomination of le Bow. It was burnt down in the fire of 1666, but ſoon afterwards rebuilt. The ſteeple of this church is reckoned the moſt beautiful of its kind in Europe.

68 Guildhall. In Cheap ward is *Guildhall*, or the town-houſe of London. This was originally built in 1411, but ſo damaged by the great fire already mentioned, as to be rebuilt in 1669. The front has a Gothic appearance; and this character is alſo due to the two gigantic effigies which ſtand within the hall. The hall is 153 feet long, 50 broad, and 55 high, adorned with the royal arms, and thoſe of the city and its companies, as well as with ſeveral portraits of Engliſh ſovereigns and judges. In this building are many apartments for tranſacting the buſineſs of the city, beſides one for each of the judicial courts, namely, that of the King's-Bench, the Common-Pleas, and the Exchequer.

69 Cheapſide. In the year 1246 Cheapſide was an open field, named *Crown-field*, from an inn with the ſign of the crown. At that time, and even for 200 years afterwards, none of the ſtreets of London were paved excepting Thames-ſtreet, and from Ludgate-hill to Charing-Croſs.

70 Goldſmiths Hall. *Goldſmiths Hall* ſtands in Foſter-lane, which opens into the weſt end of Cheapſide.—In this lane alſo is

71 St Martin's le Grand. St Martin's le Grand, which, though ſurrounded by the city, was yet ſubject, near three centuries, to Weſtminſter-Abbey. A fine college was built here in 700 by Wythred king of Kent; and, about the year 1056, rebuilt and chiefly endowed by Ingelric and Edward, two noble brothers. In 1068, it was confirmed and made independent of every other eccleſiaſtical juriſdiction, even that of the pope himſelf not excepted; and its privileges were confirmed by ſucceeding monarchs. It was governed by a dean, and a number of ſecular canons. In this juriſdiction a magnificent church was erected, but pulled down in 1548, when the college was ſurrendered; after which a tavern was erected on the ſpot. London.

72 The Croſs and Conduit. A little to the weſtward of Mary-le-Bow church (in the adjoining ward), ſtood the *Croſs* and *Conduit* in the middle of the ſtreet. The former was built by Edward I. in 1290, in memory of his queen Eleanor, whoſe body was reſted on that ſpot in its way to be buried. Originally it had the ſtatue of the queen at full length, reſembling exactly that at Northampton. Having at length fallen to decay, it was rebuilt in 1441 by John Hutherby mayor of the city, at the expence of ſeveral citizens, being now ornamented with various images, as thoſe of the Reſurrection, the Virgin Mary, &c. As the magnificent proceſſions took this road, it was new-gilt at every public entry. After the Reformation, the images gave ſo much offence, that it was thought proper to ſubſtitute that of Diana in place of the Virgin Mary. This, however, was reſented by Queen Elizabeth, who offered a reward for the diſcovery of the offenders. As ſhe imagined that a croſs, the ſymbol of the Chriſtian religion, could not juſtly give offence to any profeſſor of that religion, ſhe ordered a croſs to be placed on the ſummit, and gilt; but in 1643, the parliament ordered the demolition of all croſſes and other marks of Romiſh ſuperſtition.

Splendid tournaments were held between the Croſs and Sopers-lane in the year 1331; but as Queen Philippa and a great number of other ladies, dreſſed in rich attire, were ſitting on the upper ſcaffolding to behold the ſports, the ſeat gave way, and they ſuddenly fell down among the knights and others who ſtood below; many of whom were grievouſly hurt. The carpenters were ſaved from puniſhment by the interceſſion of the queen; but the king, to prevent accidents of the like nature, ordered a building of ſtone to be erected near Bow-church, from whence the queen and other ladies might behold ſuch ſpectacles in ſafety. This was uſed for the ſame purpoſe till the year 1410, when Henry IV. granted it to certain mercers, who converted it into ſhops, warehouſes, and other places neceſſary for their trade.

A ſmall diſtance eaſtward from the Croſs ſtood the Conduit, which ſerved to fill the leſſer ones with water brought by pipes from Paddington.—This ſtood on the ſpot where the old conduit was ſituated, which was founded in 1285, conſtructed of ſtone lined with lead, and rebuilt in 1479 by Thomas Ilan one of the ſheriffs. On ſome grand occaſions, theſe conduits have been made to run with claret; as at the coronation of Anna Bullen.

7 Mercers Hall. On the north ſide of Cheapſide ſtood the *Hoſpital of St Thomas of Acon*, founded by Fitz-Theobald de Helles, and his wife Agnes, ſiſter to the famous Thomas à Becket. The hoſpital was built 20 years after the murder of Thomas; and ſuch was his reputation

London. for ſanctity, that it was dedicated to him even before he was canonized, and that in conjunction with the Virgin Mary herſelf. The whole was granted by king Henry VIII. to the company of mercers. It was deſtroyed by the great fire in 1666; but rebuilt by the mercers company, who have their hall here.—Immediately to the eaſt is a narrow ſtreet called the *Old*

74 Old Jewry. *Jewry*, which took its name from a great ſynagogue which ſtood here till the Jews were expelled the kingdom in 1291. After them an order of friars named *Fratres de ſacca*, or *de penitentia*, took poſſeſſion of the ſynagogue; and in 1305, Robert Fitzwalter, the great banner-bearer of the city, requeſted that the friars might aſſign it to him; the reaſon of which probably was, that it ſtood near to his houſe, which was ſituated in the neighbourhood of the preſent Grocers-hall. The chapel was bought by the grocers from Fitzwalter in 1411 for 320 marks.

75 Bakewell Hall. In Baſſiſhaw or Baſing-hall ward, is *Blackwell* or *Bakewell hall*, which adjoins to Guildhall, and is the greateſt mart of woollen cloth in the world. It was purchaſed of King Richard II. by the city; and has ever ſince been uſed as a weekly market for broad and narrow woollen cloths, brought out of the country. Formerly proclamations were iſſued to compel people to bring their goods into the hall, to prevent deceit in the manufactures, which might be productive of diſcredit in foreign markets, and likewiſe be the means of defrauding the poor children of Chriſt's hoſpital of part of the revenue which aroſe from the hallage of this great magazine. It ſuffered the general devaſtation in 1666; but was rebuilt in 1672, and is now a ſpacious edifice, with a ſtone front adorned with columns.

76 Sion College. Cripplegate-ward is remarkable for a college, called *Sion-college*, founded in 1627, on the ſite of Elſing-hoſpital (D) or priory, by Dr Thomas White vicar of St Dunſtan's in the Weſt, for the improvement of the London clergy; and with alms-houſes, under their care, for 20 poor perſons, 10 men and 10 women. In the year 1631, a charter was procured for incorporating the clergy of London, by which they were conſtituted fellows of the college; and out of the incumbents are annually elected, on Tueſday three weeks after Eaſter, a preſident, two deans, and four aſſiſtants, who are to meet quarterly, to hear a Latin ſermon, and afterwards be entertained at dinner in the college-hall at the expence of the foundation. John Simpſon rector of St Olaves, who ſuperintended the building, added, at his own expence, for the uſe of the ſtudious part of the London clergy, a library 120 feet long, and amply filled with books.

77 Barbers Hall. In this ward is a hall which belonged to the company of barber-ſurgeons, the profeſſions of barber and ſurgeon being formerly exerciſed by the ſame perſon. It was built by the celebrated Inigo Jones, and the upper end is formed out of one of the towers or barbicans of London wall. The anatomical theatre is elliptical, and very finely contrived. This hall is now called *Barbers Hall*; the ſurgeons, who diſdained to be any longer aſſociated with their ancient brethren, having obtained a ſeparate charter, and built themſelves a new hall in the Old Bailey. London.

78 St Paul's Cathedral. Farringdon-ward Within, is diſtinguiſhed by the moſt magnificent Proteſtant church in the world, the cathedral of *St Paul*. The beſt authority we have for the origin of this church, is from its great reſtorer Sir Chriſtopher Wren. His opinion that there had been a church on this ſpot, built by the Chriſtians in the time of the Romans, was confirmed: when he ſearched for the foundations for his own deſign, he met with thoſe of the original *preſbyterium*, or ſemicircular chancel, of the old church. They conſiſted only of Kentiſh rubble-ſtone, artfully worked, and conſolidated with exceedingly hard mortar, in the Roman manner, much excelling the ſuperſtructure. He explodes the notion of there having been here a temple of Diana, and the diſcovery of the horns of animals uſed in the ſacrifices to that goddeſs, on which the opinion had been founded, no ſuch having been diſcovered in all his ſearches.

The firſt church is ſuppoſed to have been deſtroyed in the Dioclefian perſecution, and to have been rebuilt in the reign of Conſtantine. This was again demoliſhed by the pagan Saxons; and reſtored, in 603, by Sebert, a petty prince, ruling in theſe parts, under Ethelbert king of Kent, the firſt Chriſtian monarch of the Saxon race; who, at the inſtance of St Auguſtine, appointed Melitus the firſt biſhop of London. Erkenwald, the ſon of king Offa, fourth in ſucceſſion from Melitus, ornamented his cathedral very highly, and improved the revenues with his own patrimony. He was moſt deſervedly canonized: for the very litter, in which he was carried in his laſt illneſs, continued many centuries to cure fevers by the touch; and the very chips, carried to the ſick, reſtored them to health!

When the city of London was deſtroyed by fire, in 1086, this church was built; the biſhop Mauritius began to rebuild it, and laid the foundations, which remained till its ſecond deſtruction, from the ſame cauſe, in the laſt century. Notwithſtanding Mauritius lived twenty years after he had begun this pious work, and biſhop Beauvages enjoyed the ſee twenty more, yet ſuch was the grandeur of the deſign, that it remained unfiniſhed. The firſt had the ruins of the Palatine Tower beſtowed on him, as materials for the building; and Henry I. beſtowed on Beauvages part of the ditch belonging to the Tower, which, with purchaſes made by himſelf, enabled him to incloſe the whole with a wall. The ſame monarch granted, beſides, that every ſhip which brought ſtone for the church, ſhould be exempted from toll; he gave him alſo all the great fiſh taken in his precincts, except the tongues; and, laſtly, he ſecured to him and his ſucceſſor the delicious tythes of all his veniſon in the county of Eſſex.

The ſtyle of the ancient cathedral was a moſt beautiful Gothic; over the eaſt end was an elegant circular window; alterations were made in the ends of the

(D) This was founded by William Elſing mercer in 1329 (on the ſite of a decayed nunnery), for the ſupport of 100 blind men. He afterwards changed it into a priory, and became himſelf the firſt prior, who with four canons-regular were to ſuperintend the miſerable objects.

London. the two tranſepts, ſo that their form is not delivered down to us in the ancient plans; and from the central tower roſe a lofty and moſt graceful ſpire. The dimenſions, as taken in 1309, were theſe: The length ſix hundred and ninety feet; the breadth a hundred and twenty; the height of the roof of the weſt part, from the floor, one hundred and two; of the eaſt part, a hundred and eighty-eight; of the tower, two hundred and ſixty; of the ſpire, which was made of wood covered with lead, two hundred and ſeventy-four. The whole ſpace the church occupied was three acres and a half, one rood and a half, and ſix perches.

We may be aſtoniſhed at this amazing building, and naturally inquire what fund could ſupply money to ſupport ſo vaſt an expence. But monarchs reſigned their revenues reſulting from the cuſtoms due for the materials, which were brought to the adjacent wharfs; they furniſhed wood from the royal foreſts: prelates gave up much of their revenues; and, what was more than all, by the pious bait of indulgences, and remiſſions of penance, brought in from the good people of this realm moſt amazing ſums. Pope Innocent III. in 1252, gave a releaſe of ſixty days penance; the archbiſhop of Cologne gave, a few years before, a relaxation of fifty days; and Boniface, archbiſhop of Canterbury, forty days.

The high altar dazzled with gems and gold, the gifts of its numerous votaries. John king of France, when priſoner in England, firſt paying his reſpects to St Erkenwald's ſhrine, offered four baſons of gold: and the gifts at the obſequies of princes, foreign and Britiſh, were of immenſe value. On the day of the converſion of the tutelar ſaint, the charities were prodigious, firſt to the ſouls, when an indulgence of forty days pardon was given, *vere pœnitentibus, contritis et confeſſis*; and, by order of Henry III. fifteen hundred tapers were placed in the church, and fifteen thouſand poor people fed in the church-yard.

The holineſs of this place did not prevent thieves and profligates of all denominations from lurking within the precincts, and committing, under the favour of the night, murders and every ſort of crime. Edward I. gave the dean and canons permiſſion to incloſe the whole within a wall; and to have gates to be ſhut every night, to exclude all diſorderly people. Within theſe walls, on the north-weſt ſide, was the biſhop's palace. Froiſſart tells us, that after the great tournament in Smithfield, king Edward III. and his queen lodged here, on occaſion of their nuptials (E.) —In 1561, the noble ſpire was totally burnt by lightning, and never reſtored. London.

In conſequence of the reſolutions taken in 1620, by James I. to repair the cathedral, the celebrated Inigo Jones was appointed to the work. But it was not attempted till the year 1633, when Laud laid the firſt ſtone, and Inigo the fourth. That great architect begun with a moſt notorious impropriety, giving to the weſt end a portico of the Corinthian order, beautiful indeed, to this ancient gothic pile; and to the ends of the two tranſept gothic fronts in a moſt horrible ſtyle. The great fire made way for the reſtoring of this magnificent pile in its preſent noble form by Sir Criſtopher Wren, an architect worthy of ſo great a deſign.

It is built of fine Portland ſtone, in form of a croſs. On the outſide are two ranges of pilaſters, conſiſting of an hundred and twenty each; the lower range of the Corinthian order, and the upper of the compoſite. The ſpaces between the arches of the windows and the architrave of the lower order, are filled with a great variety of curious enrichments, as are alſo thoſe above. On the north ſide is a portico, the aſcent to which is by twelve ſteps of black marble, and its dome ſupported by ſix very large columns. Over the dome is a pediment, the face of which is engraved with the royal arms, regalia, and other ornaments. On the ſouth is a portico, the aſcent to which is by twenty-five ſteps, and its dome ſupported by ſix columns, correſponding with thoſe on the north ſide. The weſt front is graced with a moſt magnificent portico, ſupported by twelve lofty Corinthian columns: over theſe are eight columns of the compoſite order, which ſupport a noble pediment, crowned with its acroteria, and in this pediment is the hiſtory of St Paul's converſion, boldly carved in bas relief. The aſcent to this portico

(E) Before this cathedral was the famous *Paul's Croſs*, a pulpit formed of wood, mounted upon ſteps of ſtone, and covered with lead, in which the moſt eminent divines were appointed to preach every Sunday in the forenoon. To this place, the court, the mayor, and aldermen, and principal citizens, uſed to reſort. The greateſt part of the congregation ſat in the open air; the king and his train had covered galleries; and the better ſort of people were alſo protected from the injury of the weather; but the far greater part ſtood expoſed in the open air: for which reaſon the preacher went in very bad weather to a place called the Shrouds; a covered ſpace on the ſide of the church, to protect the congregation in inclement ſeaſons. Conſiderable contributions were raiſed among the nobility and citizens, to ſupport ſuch preachers as were (as was often the caſe) called to town from either of the univerſities. In particular, the lord mayor and aldermen ordered that every preacher, who came from a diſtance, ſhould be freely accommodated, during five days, with ſweet and convenient lodgings, fire, candle, and all neceſſaries. And notice was given by the biſhop of London, to the preacher appointed by him, of the place he was to repair to.

We hear of this being in uſe as early as the year 1259. It was uſed, as Mr Pennant obſerves, not only for the inſtruction of mankind by the doctrine of the preacher, but for every purpoſe political or eccleſiaſtical; for giving force to oaths, for promulging of laws, or rather the royal pleaſure, for the emiſſion of papal bulls, for anathematizing ſinners, for benedictions, for expoſing of penitents under cenſure of the church, for recantations, for the private ends of the ambitious, and for the defaming of thoſe who had incurred the diſpleaſure of crowned heads.

It was demoliſhed in 1643 by order of parliament, executed by the willing hands of Iſaac Pennington, the fanatical lord mayor of that year, who died in the Tower a convicted regicide.

London. is by a flight of ſteps of black marble, extending the whole length of the portico; and over each corner of the weſt front is a beautiful turret. A vaſt dome, or cupola, riſes in the centre of the building. Twenty feet above the roof of the church is a circular range of thirty-two columns with niches, placed exactly againſt others within. Theſe are terminated by their entablature, which ſupports a handſome gallery, adorned with a ſtone balluſtrade. Above the columns laſt mentioned is a range of pilaſters, with windows between them: and from the entablature of theſe, the diameter of the dome gradually decreaſes. On the ſummit of the dome is an elegant balcony, from the centre of which runs a beautiful lanthorn, adorned with Corinthian columns. The whole is crowned with a copper ball, ſupporting a croſs, both finely gilt. Within, the cupola ſtands on eight ſtupendous pillars, curiouſly adorned: the roof of the choir is ſupported by ſix pillars, and that of the church by two ranges, conſiſting of twenty more. The roof of the church and choir is adorned with arches and ſpacious peripheries of enrichments, admirably carved in ſtone. Quite round the inſide of the cupola, there is a whiſpering iron balcony, or gallery, the top of which is richly painted by Sir James Thornhill.

The firſt ſtone of this ſuperb edifice was laid on June 21, 1675; and the building was completed in 1710; but the whole decorations were not finiſhed till 1723. It was a moſt ſingular circumſtance, that, notwithſtanding it was 35 years in building, it was begun and finiſhed by one architect, and under one prelate Henry Compton biſhop of London. The church of St Peter's was 135 years in building, in the reigns of 19 popes, and went through the hands of twelve architects. It is not, as often miſtaken, built after the model of that famous temple: it is the entire conception of our great countryman, and has been preferred in ſome reſpects, by a judicious writer, to even the Roman Baſilica. Its dimenſions are leſs. The comparative view is given in the Parentalia, and copied in London and its Environs. The height of St Peter's, to the top of the croſs, is 437 feet and an half; that of St Paul's 340 feet; ſo that, from its ſituation, it is lofty enough to be ſeen from the ſea. The length of the firſt is 729 feet; of the latter, 500. The greateſt breadth of St Peter's is 364; of St Paul's, 180.

In the reigns of James I. and Charles I. the body of this cathedral was the common reſort of the politicians, the news-mongers, and idle in general. It was called *Paul's walk*; and is mentioned in the old plays and other books of the times.

Notwithſtanding the magnificence of this noble pile, however, it is remarked to have many defects. Its ſituation is ſuch, that it cannot be viewed at a diſtance. The diviſion of the porticos, and the whole ſtructure into two ſtories on the outſide, certainly indicate a like diviſion within, which is acknowledged to be a fault. The dome, it has alſo been obſerved, bears too great a proportion to the reſt of the pile, and ought to have been raiſed exactly in the centre of the building; beſides that, there ought to have been two ſteeples at the eaſt end, to correſpond with thoſe at the weſt. On entering this church, we inſtantly perceive an obvious deficiency, not only of elevation but length, to aſſiſt the perſpective; and the columns are heavy and clumſy, rather incumbering the proſpect than enriching it. London.

St Paul's occupies an area of ſix acres, and is railed all round with iron baluſtrades, each about five feet and an half high, fixed on a dwarf wall of hewn ſtone. In the weſt end of this area is a marble ſtatue of Queen Anne, holding a ſceptre in one hand, and a globe in the other, ſurrounded with four emblematical figures repreſenting Great Britain, France, Ireland, and America.

Beſides very large contributions for carrying on this edifice, the parliament granted a duty on ſea-coal, which, at a medium, produced 5000 l. a-year; and the whole expence of the building is ſaid to have amounted to 736,752 l. 2 s. 3 d.

On the eaſt ſide of the cathedral is *St Paul's School*, founded in 1509 by Dr John Collet dean of this church, who endowed it for a principal-maſter, an under-maſter, a chaplain, and 153 ſcholars.

79 College of Phyſicians.

In Warwick-lane, in the ſame ward, ſtands the *College of Phyſicians*, erected in 1682 by Sir Chriſtopher Wren. It is built of brick, and has a ſpacious ſtone frontiſpiece. Near the ſouth extremity of the Old Bailey, on the eaſt ſide, is the hall of the Company of Surgeons, with a theatre for diſſection.

80 Chriſt's Hoſpital.

Adjoining to Chriſt-church in Newgate-ſtreet is *Chriſt's-Hoſpital*, which, before the diſſolution of monaſteries by Henry VIII. way a houſe of grey-friars. The hoſpital was founded by King Edward VI. for ſupporting and educating the fatherleſs children of poor freemen of this city; of whom 1000 of both ſexes are generally maintained in the houſe or out at nurſe, and are likewiſe cloathed and educated. In 1673, a mathematical ſchool was founded here by Charles II. endowed with L. 320 a-year; and a writing-ſchool was added in 1694 by Sir John Moor, an alderman of the city. After the boys have been ſeven or eight years on the foundation, ſome are ſent to the univerſity and others to ſea; while the reſt, at a proper age, are put apprentices to trades at the charge of the hoſpital. At firſt their habit was a ruſſet cotton, but was ſoon after changed for blue, which has ever ſince continued to be their colour; and on this account the foundation is frequently called the *blue-coat hoſpital*. The affairs of this charity are managed by a preſident and about 300 governors, beſides the lord-mayor and aldermen. The fabric, which is partly Gothic and partly modern, was much damaged by the fire of 1666, but was ſoon repaired, and has been ſince increaſed with ſeveral additions. The principal buildings, which form the four ſides of an area, have a piazza round them with Gothic arches, and the walls are ſupported by abutments. The front is more modern, and has Doric pilaſters ſupported on pedeſtals.

81 Doctors Commons.

In Caſtle-Baynard ward is a large ſtructure called *Doctors-Commons*. It conſiſts of ſeveral handſome paved courts, in which the judges of the court of admiralty, thoſe of the court of delegates, of the court of arches, and the prerogative court, with the doctors that plead cauſes, and the proctors of the place, all live in a collegiate way; and from commoning together, as in other colleges, the name of Doctors-Commons is derived. Here courts are kept for the trial of civil and eccleſiaſtical cauſes under the archbiſhop of Canterbury

London. and the biſhop of London. The college has an excellent library, every biſhop at his conſecration giving L. 20 or L. 50 towards purchaſing books for it.

82 College of Heralds. Near Doctors-Commons, on St Bennet's Hill, is the *College of Heralds*, who were incorporated by King Richard III. Beſides the chief officer, who is the earl-marſhal of England, here are three kings at arms, *viz.* Garter, Clarencieux, and Norroy, with ſix heralds, four purſuivants, and eight proctors. Garter attends the inſtalments of knights of that order, carries the garter to foreign princes, regulates the ceremonies at coronations, and the funeral of the royal family and nobility: Clarencieux directs the funeral ceremonies of thoſe under the degree of peers ſouth of Trent; and Norroy performs the like office for thoſe north of Trent. This building was originally the houſe of the earl of Derby. It is a ſpacious quadrangle, built of brick, and has convenient apartments. Here are kept records of the coats of arms of all the families and names in England, with an account when they were granted, and on what occaſion.

83 Bridewell. In Farringdon-ward Without is a large building called *Bridewell*, from a ſpring formerly known by the name of St Bridget's or St Bride's-Well. It was originally a royal palace, and occupied all the ground from Fleet-ditch on the eaſt to Water-lane on the weſt. That part of it now called *Saliſbury-court* was given to the biſhops of Saliſbury for their town-reſidence; and the eaſt part, which was rebuilt by King Henry VIII. is the preſent Bridewell. It was granted to the city by Edward VI. as an hoſpital; and he endowed it for the lodging of poor travellers, and for the correction of vagabonds, ſtrumpets, and idle perſons, as well as for finding them work. In one part of the building 20 artificers have houſes; and about 150 boys, diſtinguiſhed by white hats and blue doublets, are put apprentices to glovers, flax dreſſers, weavers, &c. and when they have ſerved their time are intitled to the freedom of the city, with L. 10 towards carrying on their reſpective trades. The other part of Bridewell is a receptacle for diſorderly perſons, who are kept at beating hemp and other hard labour.

Near Bridewell is *St Bride's Church*, a ſtately fabric 111 feet long, 57 broad, and 41 high, with a beautiful ſpire 234 feet in altitude, and has a ring of 12 bells in its tower.

84 Blackfriars Bridge. Oppoſite to Fleet-ditch, over this part of the river, ſtands *Blackfriars Bridge*; a moſt elegant ſtructure built after the deſign of Mr Robert Mylne. The ſituation of the ground on the two ſhores obliged the architect to employ elliptical arches; which, however, have a very fine effect. The number of arches is nine; of which the centre one is 100 feet wide. The whole length is 995 feet: the breadth of the carriage-way is 28 feet, and that of the two foot-ways 7 each. Over each pier is a receſs; an apology for the beautiful Ionic pillars which ſupport them, and which have a moſt beautiful effect from the river. This bridge was begun in 1760; and finiſhed in 1768, at the expence of L. 152,840, to be diſcharged by a toll upon the paſſengers. It is ſituated almoſt at an equal diſtance between thoſe of Weſtminſter and London, commands a view of the Thames from the latter to Whitehall, and diſcovers the majeſty of St Paul's in a very ſtriking manner.

Weſt Smithfield. In this ward is an area containing three acres of ground, called in old records *Smithfield-Pond* or *Horſe-Pool*, it having been formerly a watering place for horſes. It was in ancient times the common place of execution; and at the ſouth-weſt corner there was a gallows called the *Elms*, from a number of elm-trees that grew in the neighbourhood. It was likewiſe the ſcene of public juſts and tournaments, and has been a market-place for cattle above 500 years. London. 85 Smithfield.

86 St Bartholomew's Hoſpital. On the ſouth-ſide of this area, and contiguous to Chriſt's hoſpital, is *St Bartholomew's Hoſpital*. It was originally founded ſoon after the acceſſion of Henry I. by Rahere the king's jeſter, as an infirmary for the priory of St Bartholomew the Great, which then ſtood near the ſpot. But upon the diſſolution of religious houſes, Henry VIII. refounded it, and endowed it with 500 merks a year, on condition that the citizens ſhould pay the ſame ſum annually for the relief of 100 lame and infirm patients. The endowments of this charity have ſince been ſo much enlarged, that it now receives the diſtreſſed of all denominations. In 1702, a beautiful frontiſpiece was erected towards Smithfield, adorned with pilaſters, entablature, and a pediment of the Ionic order, with a ſtatue of King Henry VIII. ſtanding in a niche in full proportion, and thoſe of two cripples on the top of the pediment over it. In 1729, a plan was formed for rebuilding the reſt of this hoſpital, in conſequence of which a magnificent edifice has been erected.

Among many other privileges granted by Henry I. to the prior and canons of the monaſtery of St Bartholomew the Great, and to the poor of the infirmary, was that of keeping a fair in Smithfield on the eve, day, and morrow, of St Bartholomew. This fair, called *Bartholomew-fair*, has been held annually ever ſince; and by the indulgence of the magiſtrates of London, to whom the privilege of keeping it devolved upon the diſſolution of the priory, it uſed to continue a fortnight. A great number of booths was erected in it by the actors of the theatres, for the exhibition of dramatic performances of various kinds; and it became at length a ſcene of ſo much licentiouſneſs and riot, that Sir John Barnard when lord mayor of London reduced the time of the fair to its original duration of three days. This laudable example has been followed ever ſince; and the magiſtrates have likewiſe prohibited all public exhibitions which had been formerly accompanied with ſo much diſorder.

87 Old Bailey. In a ſtreet in this ward, called the *Old Bailey*, is a hall named *Juſtice-hall*, or the *Seſſion's-houſe*, where a court is held eight times a year by the king's commiſſion of oyer and terminer for the trial of criminals for offences committed within the city of London and county of Middleſex. The judges of this court are the lord-mayor, thoſe of the aldermen that have ſerved that office, and the recorder, who are attended by the ſheriffs and by one or more of the national judges.

88 Newgate. In this ſtreet is alſo the great criminal priſon, lately built in a much more convenient ſituation, and on a more enlarged plan than the former priſon, called *Newgate*; by which name it is ſtill diſtinguiſhed. Here the unfortunate debtor will no longer be annoyed by the dreadful rattle of chains, or by the more horrid ſounds iſſuing from the lips of thoſe wretched beings who ſet defiance to all laws divine and human;

London. and here alſo the offender, whoſe crime is not capital, may enjoy all the benefits of a free open air.

89 Fleet-priſon. In this ward is likewiſe a priſon called the *Fleet-priſon*, from a ſmall river named the Fleet which formerly run by it: this building is large, and reckoned the beſt in the city for good rooms and other conveniences. It has the benefit of a large yard, which is encloſed with a very high wall. This priſon is as ancient as the reign of Richard I. and belongs to the court of chancery, &c.

90 The Rolls In Chancery-lane, in this ward, is an office conſiſting of a houſe and chapel, called the office and chapel of the *Rolls*, from being the great repoſitory of the modern public rolls and records of the kingdom. This building was originally the houſe of an eminent Jew; but being forfeited to the crown, King Henry III. in the year 1223 converted it into an hoſpital for the reception and accommodation of Jewiſh and other proſelytes. In 1377, Edward III. granted this hoſpital and its chapel to William Burſtall maſter of the rolls, to whoſe ſucceſſors in that office it has ever ſince belonged. Round this office there is a ſmall diſtrict conſiſting of about 200 houſes, called the *Liberty of the Rolls*, over which the magiſtrates of London have no authority, it being under the government of the maſter of the rolls.

In this ward are ſeveral *Inns* of court and chancery, particularly the Inner and Middle-Temple, Searjeant's-Inn, Clifford's-Inn, Barnard's-Inn, Staples-Inn, and Furnival's-Inn.

91 The Temple. The *Temple* received its name from being originally founded by the Knight's-Templars, who ſettled here in 1185. It was at firſt called the *New Temple*, to diſtinguiſh it from the former houſe of the Knight's-Templars, which ſtood in Holborn near Chancery-lane.

The original building was divided into three parts; the Inner, the Middle, and the Outer Temple. The Inner and the Outer Temple were ſo called, becauſe one was within and the other was without the Bar; and the Middle derived its name from being ſituated between them. Upon the diſſolution of the order of Knights-Templars, the New Temple devolved to the Knights-Hoſpitallers of St John of Jeruſalem, who granted a leaſe of it to the ſtudents of the common law, and converted that part of it called Inner and Middle Temple into two inns of court for the ſtudy and practice of the common law. The Outer Temple became a houſe for the earl of Eſſex.

The buildings of the Temple eſcaped the fire in 1666, but were moſt of them deſtroyed by ſubſequent fires, and have ſince been rebuilt. The two Temples are each divided into ſeveral courts, and have pleaſant gardens on the banks of the Thames. They are appropriated to diſtinct ſocieties, and have ſeparate halls, where the members dine in common during term-time. The Inner-Temple hall is ſaid to have been built in the reign of Edward III. and the Middle-Temple hall, which is a magnificent edifice, was rebuilt in 1572 in form of a college-hall. The Middle-Temple gate, Mr Pennant informs us, was erected by Sir Amias Powlet on a ſingular occaſion. It ſeems that Sir Amias, about the year 1501, thought fit to put Cardinal Wolſey, then parſon of Lymington, into the ſtocks. In 1515, being ſent for to London by the cardinal on account of that ancient grudge, he was commanded not to quit town till farther orders. In conſequence, he lodged five or ſix years in this gateway, which he rebuilt; and to pacify his eminence, adorned the front with the cardinal's cap, badges, cogniſance, and other devices of this butcher's ſon: ſo low were the great men obliged to ſtoop to that meteor of the times! Each temple has a good library, adorned with paintings and well furniſhed with books. An aſſembly, called a *parliament*, in which the affairs of the ſociety of the Inner-Temple are managed, is held there every term. Both Temples have one church, firſt founded in 1185 by the Knights-Templars; but the preſent edifice is ſuppoſed to have been built in 1420. It is ſupported by neat ſlender pillars of Suſſex marble, and is one of the moſt beautiful Gothic ſtructures in England. In this church are many monuments, particularly of nine Knights-Templars cut in marble in full proportion, ſome of them ſeven feet and a half long; ſix are croſs-legged, and therefore ſuppoſed to have been engaged in the cruſades. The miniſter of this church, who is uſually called the *maſter of the Temple*, is appointed by the benchers or ſenior members of both ſocieties, and preſented by a patent from the crown. Shakeſpeare (whether from tradition or hiſtory) makes the Temple garden the place in which the badge of the white and red roſe originated; the diſtinctive badge of the houſes of York and Lancaſter, under which the reſpective partizans of each arranged themſelves in the fatal quarrel which cauſed ſuch torrents of Engliſh blood to flow.

Near the Temple-bar is the *Devil Tavern*, ſo called from its ſign of St Dunſtan ſeizing the evil ſpirit by the noſe with a pair of hot tongs. Ben Jonſon has immortalized it by his *Leges Conviviales*, which he wrote for the regulation of a club of wits held here in a room he dedicated to Apollo; over the chimney-piece of which they are preſerved. The tavern was in his days kept by Simon Wadloe; whom, in a copy of verſes over the door of the Apollo, he dignified with the title of *King of Skinkers*.

92 Inns of Chancery. *Serjeant's-Inn* is a ſmall inn in Chancery-lane, where the judges and ſerjeants have chambers, but not houſes, as they had in another inn of this name in Fleet-ſtreet, which they abandoned in 1730; but in each of them there is a hall and a chapel. *Clifford's-Inn* is an inn of chancery belonging to the Inner-Temple. It was originally a houſe granted by Edward II. to the family of the Cliffords, from which it derived its name; but was afterwards let upon leaſe to the ſtudents of the law, and in the reign of Edward III. ſold to the members of this ſociety. *Bernard's-Inn* is likewiſe an inn of Chancery belonging to Gray's-Inn. It ſtands in Holborn, and was the houſe of John Mackworth dean of Lincoln, who gave it to the profeſſors of the law. *Staple's-Inn* belongs alſo to Gray's-Inn, and is ſituated in Holborn. It was once a hall for the merchants of the ſtaple for wool, whence it derives its name; but it was purchaſed by the benchers of Gray's-Inn, and has been an inn of chancery ſince the year 1415. *Furnival's-Inn* is an inn of chancery belonging to Lincoln's-Inn, and was once the houſe of the family of the Furnivals, by whom it was let out to the profeſſors of the law. It is a large old building, with a hall and a pleaſant garden.

London.

93 Bethlehem Hoſpital.

In Colman-ſtreet ward, on the ſouth-ſide of a large ſquare called *Moorfields*, ſtands *Bethlehem-hoſpital*, founded in 1675 by the lord-mayor and citizens of London for the reception and cure of poor lunatics. It is a noble edifice, built with brick and ſtone, and adorned with pilaſters, entablatures, and ſculpture; particularly with the figures of two lunatics over the grand gate, which are well executed. This building is 540 feet long and 40 broad, excluſive of two wings of a later erection, intended for the reception of ſuch lunatics as are deemed incurable. This hoſpital contains a great number of convenient cells or apartments, where the patients are maintained and receive all medical aſſiſtance without any other expence to their friends than that of bedding. The ſtructure is divided into two ſtories, through each of which runs a long gallery from one end of the houſe to the other. On the ſouth ſide are the cells, and on the north the windows that give light to the galleries, which are divided in the middle by handſome iron-gates, to keep the men and women ſeparate. This hoſpital being united to that of Bridewell, both are managed by the ſame preſident, governors, treaſurer, clerk, phyſician, ſurgeon, and apothecary; but each has a ſteward and inferior officers peculiar to itſelf.

94 St Luke's Hoſpital.

Oppoſite to Bethlehem-hoſpital ſtood that of *St Luke*, a long plain building, till of late appropiated to the ſame purpoſes, but wholly independent of the former. It was founded on the humane conſideration that Bethlehem was incapable of receiving all the miſerable objects which were offered. Of late years the patients were removed from the old hoſpital to a new one erected under the ſame name in Old-ſtreet, on the plan of the former, extending in front 393 feet. The old hoſpital is now pulled down, and replaced by a handſome row of houſes. Uncured patients may be taken in again, by a very liberal regulation, on the payment of five ſhillings a week: ſo that their friends may, if they chooſe, try a ſecond time the force of medicine on their unhappy relations or acquaintances.

95 Different Markets.

Beſides the three markets already mentioned at Smithfield for cattle and hay, at Leadenhall for butcher's meat, wool, hides, and Colcheſter baize, and at Billingſgate for fiſh; there are in this city the following other markets, which are all very conſiderable, *viz.* Honey-lane, Newgate, and Fleet-market, chiefly for fleſh, though with ſeparate diviſions for fiſh, butter, eggs, poultry, herbs, and fruit; and the Three-Cranes market, for apples and other fruit. The principal corn-market is held in a neat exchange ſituated in Mark-lane, and that for flour at Queenhithe. In Thames-ſtreet, near Billingſgate, there is an exchange for dealers in coals and maſters of veſſels in that trade to tranſact their buſineſs.

II. *The Borough of* SOUTHWARK. It was called by the Saxons *Suth*, or the "South work," in reſpect to ſome fort or fortification bearing that aſpect from London. It was alſo called the Borough, or *Burg*, probably from the ſame reaſon. It was long independent of the city of London: but, in conſideration of the inconveniences ariſing from the eſcape of malefactors from the great capital into this place, it was in 1327 granted by Edward III. to the city on payment of L. 10 annually. It was then called the *village* of Southwark; it was afterwards ſtyled the *bailiwick* of Southwark, and the mayor and commonalty of London appointed the bailiff. This power, however, not being ſufficient to remedy the evil, a more intimate connection was thought neceſſary; and in the reign of Edward VI. on a valuable conſideration paid to the crown, it was formed into a 26th ward, by the title of *Bridge-Ward Without*; with a reſervation of certain privileges enjoyed there by the archbiſhop of Canterbury and ſome other eccleſiaſtics. In conſequence of this, it was ſubjected to the lord-mayor of London, with the ſteward and bailiff. But Southwark being divided into two parts, this is to be underſtood of the diviſion called the *Borough Liberty*, which conſiſts of three of the pariſhes belonging to the town, with the greater part of a fourth pariſh. For the city diviſion, the lord-mayor by his ſteward holds a court of record every Monday at the ſeſſions-houſe on St Margaret's Hill in this borough for all debts, damages, and treſpaſſes, within the limits of his juriſdiction.—The other diviſion is called the *Clink*, or the *Manor of Southwark*, and is ſubdivided into the Great Liberty, the Guild-hall, and the King's Manor; for each of which ſubdiviſions a court-leet is held, where the conſtables, ale-conners, and fleſh-taſters, are choſen, and other buſineſs of this kind tranſacted. A court-houſe, called *Union-Hall*, has lately been built in the new ſtreet called *Union-ſtreet*, which leads in a direct line from the high-ſtreet in the Borough to Great Surry-ſtreet Blackfriars-road. The Clink liberty is under the juriſdiction of the biſhop of Wincheſter, who, beſides a court-leet, keeps here a court of record on the Bank-ſide near St Saviour's church by his ſteward or bailiff, for pleas of debt, damages, and treſpaſſes. Court-leets are alſo kept at Lambeth, Bermondſey, and Rotherhithe, three ſmall diſtricts adjoining to the Borough. —There is a counter for the impriſonment of offenders in the bailiwick, and another for the Clink liberty; to which may be added the Surry workhouſe for vagrants. Beſides theſe, there is the Marſhalſea-priſon, which is the county-gaol for felons, and the admiralty-gaol for pirates (G); in which is a court firſt erected for trials of cauſes between the king's domeſtics or menial ſervants, of which the knight-marſhal is preſident, and his ſteward judge, to whom belong four counſellors and ſix attorneys; and the court is held every Friday by him or his deputy, for debt, damages, and treſpaſſes, in cauſes for 10 miles round Whitehall, excepting London.—In this quarter is alſo the King's-bench priſon, the rules of which are above two miles in circuit, and compriſe the greateſt part of St George's Fields. Here was committed Henry prince of Wales, afterwards King Henry V. by the ſpirited and honeſt judge Gaſcoigne, for ſtriking or inſulting him on the bench.

London.

96 2. Borough of Southwark, its juriſdiction, &c.

97 Courts.

98 Priſons.

(G) In 1377 this priſon was broke open by a mob of ſailors, who murdered a gentleman confined in it for killing one of their comrades, and who had been pardoned by the court. It was again broke open by Wat Tyler and his followers in 1381. It eſcaped in the infamous riots of 1780; while the King's-Bench, the Borough-priſon, and the Clink-priſon, were nearly at the ſame inſtant ſacrificed to their fury.

London. bench. In this priſon the allowance is ſomewhat better than that of the commons priſons; for which reaſon, many debtors remove themſelves hither by *habeas corpus*. It is properly a place of confinement in all caſes triable in the King's-bench court.—The firſt time that Southwark is mentioned in hiſtory is on occaſion of Earl Goodwin's ſailing up the river to attack the royal navy of 50 ſhips lying before the palace of Weſtminſter: this was in 1052, when we are told he went *ad Suthweorce*, and ſtayed there till the return of the tide.

99 Pariſhes, &c. Southwark conſiſts of the pariſhes of St Olave, St Saviour, St George, and St Thomas; the pariſh of Chriſt-church, though contiguous to the borough, is in the county of Surry.

The principal church in Southwark is that of *St Saviour*, which was formerly a priory of regular canons. Being dedicated to the Virgin Mary, and ſituated near the bank of the Thames, it was called *St Mary Over Ree*, or *Overy*, by which appellation it is commonly known. This church is built in the manner of a cathedral, with three aiſles from eaſt to weſt, and a croſs aiſle. It is reckoned the largeſt pariſh-church in England, the three aiſles firſt mentioned meaſuring 269 feet in length, and the croſs aiſle 109 feet. The height within is 47 feet, and it has a tower with four ſpires 150 feet high.

Not far from St George's church ſtood the magnificent palace of Charles Brandon duke of Suffolk, the deſerved favourite of Henry VIII. After his death, in 1545, it came into the king's hands, who eſtabliſhed here a royal mint. It at that time was called *Southwark Place*, and in great meaſure preſerved its dignity. Edward VI. once dined in it. His ſiſter and ſucceſſor preſented it to Heath archbiſhop of York, as an inn or reſidence for him and his ſucceſſors whenever they repaired to London. As to the mint, it became a ſanctuary for inſolvent debtors; at length becoming the peſt of the neighbourhood, by giving ſhelter to villains of every ſpecies that awakened the attention of parliament; which, by the ſtatutes 8 and 9 Will. III. 9 George I. and 11 George I. entirely took away its abuſive privileges.

100 Ancient places of diverſion. In the pariſh of Chriſt-church, near the water on Bankſide, ſtood *Paris-garden*, one of the ancient playhouſes of our metropolis. Ben Jonſon is reproached by one Decker, an envious critic, with his ill ſucceſs on the ſtage, and in particular with having performed the part of Zuliman at Paris-garden. It ſeems to have been much frequented on Sundays. This profanation (Mr Pennant obſerves) was at length fully puniſhed by the dire accident which befel the ſpectators in 1582, when the ſcaffolding ſuddenly fell, and multitudes of people were killed or miſerably maimed. The omen ſeems to have been accepted; for in the next century the manor of Paris-garden was erected into a pariſh, and a church founded under the name of Chriſt's.

Beyond this place of amuſement were the Bear-garden and place for baiting of bulls, the *Britiſh circi*: "Herein (ſays Stow) were kept beares, bulls, and other beaſts to be bayted; as alſo maſtives in ſeveral kennels nouriſhed to bayt them. Theſe beares and other beaſts are there kept in plots of ground ſcaffolded about for the beholders to ſtand ſafe." This was then an amuſement for perſons of the firſt rank: our great, if not good, Elizabeth cauſed the French ambaſſadors to be carried to this theatre, to divert them with theſe bloody ſpectacles. London.

111 The Stews. Not far from theſe ſcenes of cruel paſtime was the *Bordello* or *Stews*, permitted and openly licenſed by government, nnder certain laws or regulations. They were farmed out. Even a lord-mayor did not diſdain to own them; but rented them to the *Froes*, that is "the bawds," of Flanders. Among other ſingular regulations, no ſtewholder was to admit married women; nor were they to keep open their houſes on Sundays; nor were they to admit any women who had on them the perilous infirmity of burning. Theſe infamous houſes were very properly ſuppreſſed in the reign of Henry VIII.

The biſhop of Wincheſter had formerly a palace here with a park (the ſame that is now called *Southwark-park*), which is ſince converted into warehouſes and tenements, held by leaſe from the biſhops of that ſee.

112 St Thomas's Hoſpital. Beſides ſeveral alms-houſes, there are here *St Thomas's* and *Guy's hoſpitals*, two of the nobleſt endowments in England. The former was firſt erected in 1215 by Peter de Rupibus biſhop of Wincheſter, who endowed it with land to the amount of L.343 a year; from which time it was held of the abbots of Bermondſey, one of whom in 1428 granted a right to the maſter of the hoſpital to hold all the lands it was then in poſſeſſion of belonging to the ſaid abbot and convent, the whole revenue of which did not exceed L.266: 17: 6 *per annum*. In the year 1551, after the citizens of London had purchaſed of Edward VI. the manor of Southwark and its appurtenances, of which this hoſpital was a part, they expended L.1100 in repairing and enlarging the edifice, and immediately received into it 260 patients; upon which the king in 1553 incorporated this hoſpital with thoſe of Chriſt-church and Bridewell in the city of London. The building being much decayed, three beautiful ſquares adorned with colonades were erected by voluntary ſubſcription in 1693, to which in 1732 the governors added a magnificent building, conſiſting of ſeveral wards with proper offices. The annual diſburſements of this hoſpital have for many years amounted to L.8000. The houſe is divided into 19 wards, and is ſaid to contain 474 beds.

113 Gray's Hoſpital. Adjoining to St Thomas's ſtands *Guy's-hoſpital*, perhaps the moſt extenſive charitable foundation that ever was eſtabliſhed by one man in private life. The founder of this hoſpital was Thomas Guy, a bookſeller in Lombard-ſtreet, London, who lived to ſee the edifice roofed in; and at his death, in 1724, left L.238,292, 16s. including the expence of the building, to finiſh and endow it. This hoſpital conſiſts of two capacious ſquares, containing 12 wards and 435 beds. It was incorporated by charter from parliament, and the firſt governors were appointed in 1725.

In St George's Fields, weſtward of the King's-bench priſon, is the *Magdalen hoſpital* for the reception of penitent proſtitutes; a little farther is ſituated the Aſylum for orphan girls; and not far diſtant is the Weſtminſter Lying-in hoſpital: Inſtitutions, of which the following feeling and animated account is given by Mr Pennant.

London.

114 The Aſylum.

"The *Aſylum* is an inſtitution of a moſt heavenly nature, calculated to ſave from perdition of ſoul and body the brighter part of the creation; ſuch on whom Providence hath beſtowed angelic faces and elegant forms, deſigned as bleſſings to mankind, but too often debaſed to the vileſt uſes. The hazard that theſe innocents conſtantly are liable to from a thouſand temptations, from poverty, from death of parents, from the diabolical procureſs, and often from the ſtupendous wickedneſs of parents themſelves, who have been known to ſell their beauteous girls for the purpoſe of proſtitution, induced a worthy band to found in the year 1758 the Aſylum or Houſe of Refuge. Long may it flouriſh, and eternal be the reward of thoſe into whoſe minds ſo amiable a conception entered!

115 The Magdalen Hoſpital.

"To afford means of ſalvation to thoſe unhappy beings who had the ill fortune to loſe the benefits of this divine inſtitution, the *Magdalen Hoſpital* was inſtituted for the reception of the penitent proſtitutes. To ſave from vice, is one great merit. To reclaim and reſtore to the dignity of honeſt rank in life, is certainly not leſs meritorious. The joy at the return of one ſinner to repentance is eſteemed by the higheſt authority worthy of the heavenly hoſt. That ecſtaſy, I truſt, this inſtitution has often occaſioned. Since its foundation in the ſame year with the former, to December 25th, 1786, not fewer than 2471 have been admitted. Of theſe (it is not to be wondered that long and evil habits are often incurable) 300 have been diſcharged, uneaſy under conſtraint; 45 proved lunatics, and afflicted with incurable fits; 60 have died; 52 never returned from hoſpitals they were ſent to; 338 diſcharged for faults and irregularities. How to be dreaded is the entrance into the bounds of vice, ſince the retreat from its paths is ſo difficult! Finally, 1608 prodigals have been returned to their rejoicing parents; or placed in reputable ſervices, or to honeſt trades, banes to idleneſs and ſecurities againſt a future relapſe."—Into this charity, every woman who has been ſeduced (and is not pregnant or diſeaſed), whether recommended or not, may apply for admiſſion to the committee, who meet for that purpoſe on the firſt Tueſday in every month.

116 Lying-in Hoſpital.

Akin to thoſe charities is that of the *Lying-in Hoſpital*: which is not intended merely for the reception of "the honeſt matron who can depoſit her burden with the conſciouſneſs of lawful love; but alſo for the unhappy wretches whom ſome villain in the unguarded moment has ſeduced, and then left a prey to deſertion of friends, to poverty, want, and guilt. Leſt ſuch 'may be driven to deſpair by ſuch complicated miſery, and be tempted to deſtroy themſelves and murder their infants,' here was founded in 1765 this humane preventative the Weſtminſter New Lying-in Hoſpital, in which every aſſiſtance and accommodation requiſite in ſuch ſituations are provided in the moſt attentive and liberal manner. To obviate all objection to its being an encouragement to vice, no one is taken in a ſecond time: but this moſt excellent charity is open to the worthy diſtreſſed matron as often as neceſſity requires. None are rejected who have friends to recommend. And of both deſcriptions upwards of 4000 have experienced its ſalutary effect." London.

117 St George's Fields.

St George's Fields are now almoſt covered with new-erected buildings, from the ditch at the end of Great Surry-ſtreet, or Burrow's buildings, to the Fiſhmongers almſhouſes, in one direction; and from the Marſhalſea-priſon to the Dog and Duck, in the other direction; with ſeveral irregular indentions in its circumference: And where the principal roads meet an obeliſk has been erected, pointing out the diſtance it ſtands from different parts of London, Weſtminſter, and Blackfriars bridges. Among the buildings which ſerve to embelliſh and improve this entrance to London, Chatham ſquare and Bridgeſtreet Blackfriars may be particularly ſpecified.

118 Lambeth Palace.

At *Lambeth*, the archbiſhops of Canterbury have had a palace. According to Mr Pennant, it was in the earlier times a manor, poſſibly a royal one; for the great Hardiknut died here in 1042, in the midſt of the jollity of a wedding dinner; and here, without any formality, the uſurper Harold is ſaid to have ſnatched the crown and placed it on his own head. At that period it was part of the eſtate of Goda, wife to Walter Earl of Mantes, and Euſtace Earl of Boulogne; who preſented it to the church of Rocheſter, but reſerved to herſelf the patronage of the church. It became in 1197 the property of the ſee of Canterbury, by exchange tranſacted between Glanville Biſhop of Rocheſter, and the Archbiſhop Hubert Walter. The building was improved by Langton the ſucceſſor of Walter; but it was afterwards neglected and became ruinous. "No pious zeal (ſays Mr Pennant) reſtored the place, but the madneſs of prieſtly pride. Boniface, a wrathful and turbulent primate, elected in 1244, took it into his head to become a viſitor of the priory of St Bartholomew, to which he had no right. The monks met him with reverential reſpect, but aſſured him the office did not belong to the biſhop. The meek prelate ruſhed on the ſubprior, knocked him down, kicked, beat, and buffeted him, tore the cope off his back, and ſtamped on it like one poſſeſſed, while his attendants paid the ſame compliments to all the poor monks. The people enraged at his unprieſtly conduct would have torn him to pieces; when he retired to Lambeth, and, by way of expiation, rebuilt it with great magnificence. —At a ſubſequent period it was very highly improved by the munificent Henry Chichely, who enjoyed the primacy from 1414 to 1443. I lament to find ſo worthy a man to have been the founder of a building ſo reproachful to his memory as the Lollards tower, at the expence of near L. 280. Neither Proteſtants or Catholics ſhould omit viſiting this tower, the cruel priſon of the unhappy followers of Wickliffe. The vaſt ſtaples and rings to which they were chained before they were brought to the ſtake, ought to make Proteſtants bleſs the hour which freed them from ſo bloody a religion." During the civil wars of the laſt century, this palace ſuffered greatly; but at the reſtoration, the whole was repaired by Archbiſhop Juxton.

The pariſh church of Lambeth (H), which is at a ſmall diſtance

(H) In deſcribing this church, Mr Pennant takes occaſion to mention the ſad example of fallen majeſty in the perſon of Mary d'Eſte, the unhappy queen of James II.; who flying with her infant prince from the ruin

London.

119 and church.

distance from the palace, has a plain tower; and the architecture is of the gothic of the time of Edward IV. It has very little remarkable in it, except the figure of a pedlar and his dog, painted in one of the windows; and tradition says, that the parish was obliged to this man for the bequest of a piece of land, which bears the name of *the Pedlar's Acre*. In the churchyard is the tomb of old Tradescant. Both father and son were great travellers; and the former is supposed to have visited Russia and most parts of Europe, Turkey, Greece, many of the eastern countries, Egypt, and Barbary; out of which he introduced multitudes of plants and flowers, unknown before in our gardens. The monument is an altar tomb; embellished with emblematical sculptures; and bearing the following inscription, which is both singular and historical:

Know, stranger, ere thou pass, beneath this stone
Lye John Tradescant, grandsire, father, son;
The last dy'd in his spring; the other two
Liv'd till they had travell'd Art and Nature through,
As by their choice collections may appear,
Of what is rare, in land, in sea, in air;
Whilst they (as Homer's Iliad in a nut)
A world of wonders in one closet shut:
These famous Antiquarians, that had been
Both gardeners to the Rose and Lily Queen,
Transplanted now themselves, sleep here; and when
Angels shall with their trumpets wake men,
And fire shall purge the world, these hence shall rise,
And change this garden for a paradise.

120 Lambeth-marsh.

From Lambeth, eastward along the river side, was once a long tract of dreary marsh, and still in parts called *Lambeth-marsh*; about the year 1560, there was not a house on it from Lambeth palace as far as Southwark. In a street called *Narrow-wall* (from one of the ancient embankments) is Mrs Conde's noted manufactory of artificial stone (I): And at a small distance, Messr. Beaufoy's great work for making wines (K), and that for making vinegar (L).

London.

121 Great manufactories.

This ground, so profitable to the proprietors, and so productive of revenue to the state, was within memory the scene of low dissipation. Here stood Cuper's garden, noted for its fire-works, and the great resort of the profligate of both sexes. This place was ornamented with several of the mutilated statues belonging to Thomas Earl of Arundel, which had been for that purpose begged from his lordship by one Boyder Cuper, a gardener in the family. The great timber-yards beneath which these antiquities were found, are very well worthy of a visit. One would fear that the forests of Norway and the Baltic would be exhausted, to supply the want of our overgrown capital, were we not assured that the resources will successively be increasing equal to the demand of succeeding ages.—In this parish are also the vast distilleries, till of late the property of Sir Joseph Mawbey; where are seldom less than 2000 hogs constantly grunting, and kept entirely on the grains.

122 City and liberties of Westminster.

III. *City and Liberties of* WESTMINSTER. The city of Westminster derives its name from a *minster*, or abbey, and *west*, on account of its situation with respect to St Paul's cathedral, which was formerly called *East-minster*. In ancient times this district stood upwards of a mile from the city of London, and contained only two parishes, which were those of St Margaret and St John, with two chapels of ease, but at present it has seven other parochial churches, viz. St Clement's Danes, St Paul's Covent-garden, St Mary's-le-Strand, St Martin's in the Fields, St Anne's, St James's, and St George's Hanover-square.

Westminster

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ruin impending over their house, after crossing the Thames from the abdicated Whitehall, took shelter beneath the ancient walls of this church a whole hour, from the rain of the inclement night of December 6th, 1688. Here she waited with aggravated misery, till a common coach, procured from the next inn, arrived, and conveyed her to Gravesend, from whence she sailed, and bid an eternal adieu to these kingdoms.

(I) Her repository consists of several very large rooms filled with every ornament which can be used in architecture. The statue, the vase, the urn, the rich chimney-pieces, and, in a few words, every thing which could be produced out of natural stone or marble by the most elegant chisel, is here to be obtained at an easy rate.

(K) "Where (says Mr Pennant) the foreign wines are most admirably mimicked. Such is the prodigality and luxury of the age, that the demand for many sorts exceeds in a great degree the produce of the native vineyards. We have skilful fabricators, who kindly supply our wants. It has been estimated, that half of the port, and five-sixths of the white wines consumed in our capital, have been the produce of our home wine presses. The product of duty to the state from a single house was in one year, from July 5th 1785, to July 5th 1786, not less than L. 7,363 : 9 : 8½. The genial banks of the Thames opposite to our capital, yield almost every species of white wine; and by a wondrous magic, Messr. Beaufoy pour forth the materials for the rich Frontiniac, to the more elegant tables; the Maderia, the Calcavella, and the Lisbon, into every part of the kingdom."

(L) "There is a magnificence of business (our author remarks) in this ocean of sweets and sours, that cannot fail exciting the greatest admiration: whether we consider the number of vessels or their size. The boasted tun at Heydelberg does not surpass them. On first entering the yard, two rise before you, covered at the top with a thatched dome; between them is a circular turret, including a winding staircase, which brings you to their summits, which are above 24 feet in diameter. One of these conservatories is full of sweet wine, and contains 58,109 gallons, or 1,815 barrels of Winchester measure. Its superb associate is full of vinegar, to the amount of 56,799 gallons, or 1,774 barrels of the same standard as the former. The famous German vessel yields even to the last by the quantity of 40 barrels.—Besides these, is an avenue of lesser vessels, which hold from 32,500 to 16,974 gallons each. After quitting this Brobdignagian scene, we pass to the acres covered with common barrels: we cannot diminish our ideas so suddenly, but at first we imagined we could quaff them off as easily as Gulliver did the little hogsheads of the kingdom of Lilliput."

123 Government of Weſtminſter.

Weſtminſter was anciently called Thorny-iſland, from its having been covered with thorn-buſhes, and encompaſſed by a branch of the Thames, which is ſaid to have run through the ground now called St James's-park, from weſt to eaſt, and to have rejoined the river at Whitehall.

Till the general diſſolution of religious houſes, Weſtminſter was ſubject to the arbitrary rule of its abbot and monks; but in 1541, upon the ſurrender of William Benſon the laſt abbot, Henry VIII. not only turned it into an honour, but created it the ſee of a biſhop, and appointed for a dioceſe the whole county of Middleſex, except Fulham, which belonged to the biſhop of London. This biſhoprick, however, ſoon after its inſtitution, was diſſolved by Edward VI.

The city of Weſtminſter is governed by a high ſteward, an officer of great dignity, who is uſually one of the firſt peers in the realm; and is choſen for life by the dean and chapter of the collegiate church of St Peter. There is alſo a deputy ſteward and a high bailiff, who alſo hold their offices for life; being nominated by the dean and chapter, and confirmed by the high ſteward.

The dean and chapter are inveſted with an eccleſiaſtical and civil juriſdiction within the liberties of Weſtminſter, St Martin's-le-Grand, near Cheapſide, in the city of London, and ſome towns in Eſſex, which are exempted from the juriſdiction of the biſhop of London and the archbiſhop of Canterbury.

124 Churches.

St Margaret's church was founded by Edward the Confeſſor, ſince which time it has been frequently rebuilt. In the eaſt end of this church is a window curiouſly painted, with the hiſtory of the crucifixion, and with the figures of ſeveral apoſtles and ſaints finely executed. It formerly belonged to a private chapel at Copt-hall, near Epping in Eſſex, and was purchaſed by the officers of this pariſh ſome years ago for 400 guineas. In this church the houſe of commons attends divine ſervice on ſtate holidays.

The *church of St John the Evangeliſt* was erected in 1728, and having ſunk conſiderably whilſt it was building, occaſioned an alteration of the plan. On the north and ſouth ſides are magnificent porticoes, ſupported by vaſt ſtone pillars, as is alſo the roof of the church; at each of the four corners is a beautiful ſtone tower and pinnacle, which were added with the view of making the whole ſtructure ſink equally. The parts of this building are held together by iron bars, which run acroſs even the ailes.

125 Weſtminſter-abbey, and its chapels.

The moſt remarkable ſtructure in Weſtminſter is the *abbey-church of St Peter*. On its ſite ſtood once a temple of Apollo, which according to tradition was thrown down by an earthquake in the time of Antoninus Pius; and from the ruins of which, Sebert king of the Weſt Saxons raiſed a Chriſtian church, which was ruined by the Danes. It was repaired by Edward the Confeſſor, and given to a few monks; and this ſpot he choſe for his burial-place. Henry III. 160 years after, took down this fabric of Edward's, and erected a new church, which was 50 years in building. It ſuffered much by fire in 1274, but was repaired by Edward I. Edward II. and the abbots. In 1700 this church being much decayed, the parliament granted money for repairing it, and has frequently repeated the bounty ſince that time. The form of the abbey is that of a long croſs; its greateſt length is 489 feet, and the breadth of the weſt front 66 feet; the length of the croſs aile is 189 feet, and the height of the roof 92 feet. At the weſt end are two towers: the nave and croſs aile are ſupported by 50 ſlender pillars of Suſſex marble, excluſive of pilaſters. In the upper and lower ranges there are 94 windows, all which, with the arches, roofs, and doors, are in the Gothic taſte. The inſide of this church is much better executed than the outſide: and the perſpective is good, particularly that of the grand aile. The choir, from which there is an aſcent by ſeveral ſteps to a fine altar-piece, is paved with black and white marble; having 28 ſtalls on the north, the ſame number on the ſouth, and eight at the weſt end. The altar is made of a beautiful piece of marble, the gift of Queen Anne, incloſed by a curious baluſtrade, and upon a pavement of porphyry, jaſper, Lydian, and ſerpentine ſtones, laid in the Moſaic ſtyle, at the expence of abbot Ware, A. D. 1272; and is ſaid to be one of the moſt beautiful of its kind in the world. On each ſide of this altar a door opens into St Edward's chapel; round which are 10 other chapels, ranging from the north to the ſouth croſs ailes, and are dedicated, 1. To St Andrew. 2. To St Michael. 3. To St John Evangeliſt. 4 Iſlip's chapel. 5. To St John Baptiſt. 6. To St Paul. 7. Henry V.'s chapel. 8. To St Nicholas. 9. To St Edmund. 10. To St Benedict.

In St Edward's chapel are ſtill to be ſeen the remains of his ſhrine; which, though now in obſcurity, and robbed of all its riches and luſtre, was once eſteemed the glory of England, ſo far as art and riches could make it. Here are the tombs of King Edward I. and ſeveral other kings and queens of England; and here alſo is ſhown the famous chair in which the kings of Scotland uſed to be crowned at Scoon. Henry V.'s chapel is divided from St Edward's by an iron ſcreen, on each ſide of which are ſtatues as big as life.—St Andrew's chapel, which is next the north croſs, and the others which ſurround the choir, are crowded with the monuments of noble perſonages, worthy the attention of the curious.—At the corner of St Benedict's chapel, an iron gate opens into the ſouth croſs aile; which from the number of monuments erected therein to celebrated Engliſh poets, has obtained the name of the *Poets corner*: though here we find a moſt magnificent monument erected at the ſouth end in memory of the late John duke of Argyle and Greenwich; another to William Camden the antiquarian; and others to the celebrated divine Dr Iſaac Barrow, to Thomas Parr who died at the age of 152 years, &c.—The ſouth aile is adorned with 19 curious monuments of the pious, the brave, and the learned; and turning northward from the weſt door, we view a great number more.

126 Henry's chapel.

On the eaſt of the abbey, and which, though ſeparate from the other chapels in the choir, ſeems to be one and the ſame building with the abbey, ſtands the chapel of King Henry VII. which that king founded in the year 1502, and was at that time ſtyled the *wonder of the world*, and is now one of the moſt expenſive remains of the ancient Engliſh taſte and magnificence. There is no looking upon it without admiration:

London. miration: it conveys an idea of the fine taſte of Gothic architecture in that age: and the inſide is ſo noble, majeſtic, and of ſuch curious workmanſhip, that it would take a volume to deſcribe each part with juſtice and propriety.

Its original intention was to be a dormitory for the royal blood: and ſo far the will of the founder has been obſerved, that none have been interred therein but ſuch as have traced their deſcent from ancient kings. The tomb of King Henry VII. is moſt magnificent, incloſed with a ſcreen of caſt braſs, moſt admirably deſigned, and as well executed. Within the rails are the figures of that king and his royal conſort, in their robes of ſtate, on a tomb of black marble: and at the head of this tomb lie the remains of Edward VI. In different parts of this chapel are the monuments of Lewis Stuart duke of Richmond, George Villars duke of Buckingham, John Sheffield duke of Buckingham, Charles Montague marquis of Hallifax, Edward V. and his brother Richard; the vault of James I. and his queen Anne and daughter Mary, on which is a ſmall tomb adorned with the figure of a child; a lofty monument of Queen Elizabeth, and another of Mary Queen of Scots; the monuments for Margaret Douglas daughter of Margaret queen of Scots, Margaret counteſs of Richmond mother to Henry VII. the vault of King Charles II. and William III. Queen Mary his conſort, Queen Anne, and Prince George. Over theſe royal perſonages are their effigies (except that of prince George) in wainſcot preſſes, made of wax to reſemble life, and dreſſed in their coronation robes. And at the corner of the great eaſt window, in another wainſcot preſs, ſtands the effigy of Mary ducheſs of Richmond daughter to James duke of Richmond and Lenox, dreſſed in the very robes ſhe wore at the coronation of Queen Anne. On leaving the aiſle, you are ſhown another preſs, containing the effigy of general Monk, who, on account of his loyalty, and the part he took in the reſtoration of King Charles II. had a vault appropriated to him and his family amongſt the royal blood.

In a fine vault under Henry the VII.'s chapel, is the burying-place of the preſent royal family, erected by his late majeſty king George II. Adjoining to the abbey are the cloyſters, built in a quadrangular form, with piazzas towards the court, where ſeveral of the prebendaries have their houſes.

127 Weſtminſter School. Near the abbey church is the King's ſchool, uſually called *Weſtminſter School*. It was originally founded in 1070, and a ſecond time by Queen Elizabeth in 1560, whence it is ſometimes called the *Queen's College*; and is at preſent one of the greateſt ſchools in the kingdom. The learned antiquary Mr Cambden was once maſter of it, and Ben Jonſon one of his ſcholars. Dr Buſby, who was maſter upwards of 50 years, greatly contributed to keep up its reputation, formed its muſeum, and improved both the maſter's and his prebendal houſe.—This ſchool, inſtead of one maſter and one uſher as at firſt, has now an upper and under maſter, and five uſhers, who have about 400 youths under their tuition. A plan was ſet on foot when the preſent archbiſhop of York was maſter, for building a college for the uſe of the ſtudents, but this did not ſucceed.

On the north-eaſt ſide of the abbey is an old Gothic building called *Weſtminſter-hall*, firſt built by William Rufus as an addition to a royal palace, and afterwards rebuilt by Richard II. in the year 1397. It is reckoned one of the largeſt rooms in Europe, being 200 feet long, 70 broad, and 90 high, ſupported only by buttreſſes. The roof is of timber, and was ſome years ago flated, the old covering of lead being reckoned too heavy. It is paved with ſtone. In this ſpacious room the kings of England have generally held their coronation and other ſolemn feaſts; and it is uſed for the trial of peers. Since the reign of Henry III. the three great courts of Chancery, King's Bench, and Common Pleas, have been held in ſeparate apartments of this hall; and the court of Exchequer above ſtairs.

London. 128 Weſtminſter-hall.

129 Houſe of Commons. Adjoining to the ſouth-eaſt angle of Weſtminſter-hall is a building formerly called *St Stephen's Chapel*, from its having been dedicated to that ſaint. It was founded by King Stephen; and in 1347 was rebuilt by King Edward III. who converted it to a collegiate church; but ſince it was ſurrendered to Edward VI. it has been uſed for the aſſembly of the repreſentatives of the commons of England, and is now generally called the *Houſe of Commons*. The benches, which aſcend behind one another as in a theatre, are covered with green cloth; the floor is matted; and round the room are wainſcot galleries, ſupported by cantilevers adorned with carved work, in which ſtrangers are often permitted to ſit and hear the debates.

130 Houſe of Lords. On the ſouth ſide of the hall is the *Houſe of Lords*, ſo called from being the place where the peers of Great Britain aſſemble in parliament. It is an oblong room, not quite ſo large as the houſe of commons; and is hung with fine old tapeſtry, repreſenting the defeat of the Spaniſh Armada in 1588. The deſign was drawn by Cornelius Vroom, and the tapeſtry executed by Francis Spiering. It was not put up till the year 1650, two years after the extinction of monarchy, when the houſe of lords was uſed as a committee-room for the houſe of commons. The heads of the naval heroes who commanded on the glorious day form a matchleſs border round the work, animating poſterity to emulate their illuſtrious example. Here is a throne for the king, with ſeats on the right and left for ſuch peers of the realm as are of the blood royal. Before the throne are three broad ſeats; on the firſt of which, next the throne, ſits the Lord Chancellor, or keeper of the great ſeal, who is ſpeaker of the houſe of peers; and on the other two ſit the judges, the maſter of the rolls, or the maſters in chancery, who attend occaſionally to give their opinions on points of law. The two archbiſhops ſit at ſome diſtance from the throne on the right hand, and the other biſhops in a row under them. All the benches are covered with red cloth ſtuffed with wool. Here likewiſe, by a late order of the houſe, a gallery for ſtrangers has been erected.

131 Prince's Chamber, &c. Adjoining to the houſe of lords is the *Prince's Chamber*, where the king is robed when he comes to the parliament. On the other ſide is the *Painted Chamber*, which is ſaid to have been Edward the Confeſſor's bed-chamber, and the room in which the parliaments were anciently opened. Here conferences

London. are often held between the two houſes, or their committees. Contiguous to thoſe is an apartment called the *Court of Requeſts*, where ſuch as have buſineſs in either houſe may attend.

132 Weſtminſter bridge. Near theſe buildings is a bridge over the Thames, called *Weſtminſter-bridge*, accounted one of the moſt complete and elegant ſtructures of the kind in the known world. It is built entirely of ſtone, and extends over the river at a place where it is 1223 feet broad; which is above 300 feet broader than at London bridge. On each ſide is a fine balluſtrade of ſtone, with places of ſhelter from the rain. The width of the bridge is 44 feet, having on each ſide a fine foot-way for paſſengers. It conſiſts of 14 piers, and 13 large and two ſmall arches, all ſemicircular, that in the centre being 76 feet wide, and the reſt decreaſing four feet each from the other, ſo that the two leaſt arches of the 13 great ones are each 52 feet. It is computed that the value of 40,000l. in ſtone and other materials is always under water. This magnificent ſtructure was begun in 1739, and finiſhed in 1750, at the expence of 389,000 l. defrayed by the parliament. It was built after the deſign of Monſ. Labelye, an ingenious architect, a native of France.

133 Whitehall. On the bank of the Thames, at the eaſt confines of St Margaret's pariſh, was a palace called *Whitehall*, originally built by Hubert de Burgh earl of Kent, before the middle of the 13th century. It afterwards devolved to the archbiſhop of York, whence it received the name of *York Place*, and continued to be the city reſidence of the archbiſhops till it was purchaſed by Henry VIII. of cardinal Wolſey in 1530. At this period it became the reſidence of the court; but in 1697 was deſtroyed by accidental fire, all except the banqueting-houſe, which had been added to the palace of Whitehall by James I. according to a deſign of Inigo Jones. This is an elegant and magnificent ſtructure of hewn ſtone, adorned with an upper and lower range of pillars, of the Ionic and Compoſite orders; the capitals are enriched with fruit and foliages, and between the columns of the windows. The roof is covered with lead, and ſurrounded with a baluſtrade. The building chiefly conſiſts of one room of an oblong form, 40 feet high, and a proportionable length and breadth. The cieling is painted by the celebrated Sir Peter Paul Rubens. It is now uſed only as a chapel-royal, and the other part of the houſe is occupied with ſtate-offices.

134 Horſe-guards. Oppoſite to the banqueting-houſe ſtands the *Horſe-guards*, ſo called from being the ſtation where that part of his majeſty's troops uſually do duty. It is a ſtrong building, of hewn ſtone, conſiſting of a centre and two wings. In the former is an arched paſſage into St James's Park; and over it, in the middle, riſes a cupola. In a part of the building is the War-office. Near the Horſe-guards is the *Treaſury*; a large building, which fronts the Parade in St James's Park; and where the board of treaſury is kept.

135 Admiralty-office. Eaſtward of the Horſe-guards is the *Admiralty-Office*, a large pile, built with brick and ſtone. The front towards Whitehall has two deep wings, and a lofty portico ſupported by four large ſtone pillars. A piazza, conſiſting of beautiful columns, runs almoſt from one end to the other. The wall before the court has been lately built in an elegant manner, and each ſide of the gate is ornamented with naval emblems. Beſides a hall, and other public apartments, here are ſpacious houſes for ſeven commiſſioners of the admiralty. London.

136 Charing-croſs. At a little diſtance from the admiralty, where three capital ſtreets terminate, is a large opening called *Charing-croſs*, from one of the croſſes which king Edward I. cauſed to be erected in memory of his queen Eleanor, and *Charing* the name of a village in which it was built. The croſs remained till the civil wars in the reign of Charles I. when it was deſtroyed by the fanatics, as a monument of popiſh ſuperſtition; but after the Reſtoration, an equeſtrian ſtatue of Charles I. was ſet up in its ſtead. This, which is of braſs, and finely executed, continues to be an ornament to the place. It was made in 1633, at the expence of the Howard-Arundel family. The parliament ſold it to a brazier in Holborn, with ſtrict orders to break it to pieces; but he concealed it under ground till the Reſtoration, when it was ſet up in 1678.

137 Queen's Palace. At the weſt end of the Mall, in St James's Park, which begins near Charing-croſs, ſtands the *Queen's Palace*. It was originally known by the name of *Arlington-houſe*; but being purchaſed by the late duke of Buckingham's father, who rebuilt it from the ground in 1703, it was called *Buckingham-houſe*, till the year 1762, when it was purchaſed by his majeſty for a royal reſidence. It is built of brick and ſtone, having in the front two ranges of pilaſters of the Corinthian and Tuſcan orders. It has a ſpacious court-yard, incloſed with iron rails, fronting St James's Park, with offices on each ſide, with two pavilions, ſeparated from the manſion-houſe by colonades of the Tuſcan, Doric, and Ionic orders. His majeſty has here built a fine library, in an octagonal form, beſides ſeveral other additions.

138 St James's. Eaſtward of the queen's palace ſtands *St James's*, an old building, which, till the former was purchaſed by the crown, had been the town-reſidence of the royal family ſince the burning of Whitehall in 1697. This palace was built by Henry VIII. and obtained its name from an hoſpital which formerly ſtood on the ſpot. It is an irregular building, of a mean appearance without, but contains ſeveral magnificent apartments. Here the court and levees are ſtill kept, and moſt of the perſons belonging to the houſhold have their reſidence. The chapel of the hoſpital was converted to the uſe of the royal family, as it now remains, and is a royal peculiar, exempted from all epiſcopal juriſdiction.

139 The Park and Mall. When this palace was built, it abutted in the ſouth-weſt upon an uncultivated ſwampy tract of ground, which the king incloſed and converted into a park, called from the palace *St James's Park*. He alſo laid it out into walks, and collected the water into one body. It was afterwards much enlarged and improved by king Charles II. who planted it with lime trees, and formed a beautiful viſta, near half a mile in length, called the *Mall*, from its being adapted to a play at bowls diſtinguiſhed by that name. He alſo formed the water into a canal 100 feet broad and 2800 feet long; and furniſhed the park with a decoy, and other pond for water-fowl; but thoſe have lately

London. been deſtroyed, on account of the unwholeſome vapours which they excited.

In a line with St James's palace, on the eaſt ſide, is *Marlborough Houſe*, which belongs to the duke of Marlborough, and is a large brick edifice, ornamented with ſtone.

140 The Strand, when firſt formed. Eaſtward from Charing-croſs, runs that fine ſtreet the *Strand*, which terminates at Temple-bar. In the year 1353 the whole of it was an open highway, with gardens to the water-ſide. In that year it was ſo ruinous, that Edward III. by an ordinance directed a tax to be raiſed upon wool, leather, wine, and goods carried to the ſtaple at Weſtminſter, from Temple-bar to Weſtminſter abbey, for the repair of the road; and that all owners of houſes adjacent to the highway ſhould repair as much as lay before their doors. Before the above period, it entirely cut off Weſtminſter from London; nothing intervened except the ſcattered houſes, and a village which afterwards gave name to the whole; and St Martin's ſtood literally in the fields. But about the year 1560 a ſtreet was formed, looſely built; for all the houſes on the ſouth ſide had great gardens to the river, were called by their owners names, and in after-times gave name to the ſeveral ſtreets that ſucceeded them, pointing down to the Thames; each of them had ſtairs for the conveniency of taking boat, of which many to this day bear the names of the houſes. As the court was for centuries either at the palace of Weſtminſter or Whitehall, a boat was the cuſtomary conveyance of the great to the preſence of their ſovereign. The north ſide was a mere line of houſes from Charing-croſs to Temple-bar; all beyond was country. The gardens which occupied part of the ſite of Convent-garden were bounded by fields, and St Giles's was a diſtant country village. Our capital found itſelf ſo ſecure in the vigorous government of queen Elizabeth, that, by the year 1600, moſt conſiderable additions were made to the north of the long line of ſtreet juſt deſcribed. St Martin's-lane was built on both ſides. St Giles's church was ſtill inſulated: but Broad-ſtreet and Holburn were completely formed into ſtreets with houſes all the way to Snow-hill. Convent-garden and Lincoln's inn fields were built, but in an irregular manner. Drury-lane, Clare-ſtreet, and Long-acre, aroſe in the ſame period.

141 Northumberland Houſe. Almoſt contiguous to Charing-croſs, and upon the ſouth ſide of the Strand, is that noble palace called *Northumberland-houſe*, which ſtands on the ſite of the hoſpital of St Mary Rounceval. Henry VIII. granted it to Sir Thomas Caverden. It was afterwards transferred to Henry Howard earl of Northampton; who, in the time of James I. built here a houſe, and called it after his own name. He left it to his kinſman the earl of Suffolk, lord treaſurer; and by the marriage of Algernoon Percy earl of Northumberland, with Eliſabeth daughter of Theophilus earl of Suffolk, it paſſed into the houſe of the preſent noble owner. The greater part of the houſe was built by Bernard Janſen, an architect in the reign of James I. The front next the ſtreet was begun by Algernoon in 1748, and finiſhed by the preſent duke, who married his daughter. Two additional wings to the front next the Thames, and a variety of other improvements both in building and furniture, have contributed to render this houſe the largeſt and moſt magnificent in London. It contains a gallery of 106 feet long by 26 wide moſt ſuperbly furniſhed. London.

142 Durham Yard. A ſhort way eaſtward, on the ſame ſide, ſtood *Durham Yard*, which took its name from a place built originally by the illuſtrious Thomas de Hatfield, elected biſhop of Durham in 1345; deſigned by him for the town reſidence of him and his ſucceſſors. At this place, in 1540, was held a moſt magnificent feaſt, given by the challengers of England, who had cauſed to be proclaimed, in France, Flanders, Scotland, and Spain, a great and triumphant juſting to be holden at Weſtminſter, for all comers that would undertake them But both the challengers and defendants were Engliſh. After the gallant ſports of each day, the challengers rode unto this Durham-houſe, where they kept open houſehold, and feaſted the king and queen (Anne of Cleves) with her ladies, and all the court. In the reign of Edward VI. the mint was eſtabliſhed in this houſe, under the management of Sir William Sharrington, and the influence of the aſpiring Thomas Seymour, lord admiral. Durham-houſe was reckoned one of the royal palaces belonging to queen Elizabeth; who gave the uſe of it to the great Sir Walter Raleigh.

143 The Adelphi. Durham-yard is now filled with a moſt magnificent maſs of building, called the *Adelphi*, in honour of two brothers, the ingenious Adams, its architects. Beſides its fine lodgings, it is celebrated for its enchanting proſpect, the utility of its wharfs, and its ſubterraneous apartments anſwering a variety of purpoſes of general benefit.

144 The Savoy. Farther on ſtand the ruins of the *Savoy*. Henry III. had granted to Peter of Savoy, uncle to his queen Eleanor, daughter of Berrrenger of Provence, all the houſes upon the Thames where this building now ſtands, to hold to him and his heirs, yielding yearly at the Exchequer three barbed arrows for all ſervices. This prince founded the Savoy, and beſtowed it on the foreign hoſpital of Montjoy. Queen Eleanor purchaſed it, and beſtowed it on her ſon Edmund earl of Lancaſter. It was rebuilt in a moſt magnificent manner by his ſon Henry. It was made the place of confinement of John king of France in 1356, after he was taken priſoner at the battle of Poitiers. In 1381 it was entirely deſtroyed by Wat Tyler, out of ſpleen to the great owner John of Gaunt. Henry VII. began to rebuild it, with a deſign of forming it into an hoſpital for a hundred diſtreſſed people, and Henry VIII. completed the deſign. The revenues, at the ſuppreſſion by Edward VI. amounted to above 500l. a year. Queen Mary reſtored it; and her maids of honour, with exemplary piety, furniſhed it with all neceſſaries. It was again ſuppreſſed by Queen Eliſabeth; and at preſent part ſerves as lodgings for private people, for barracks, and a ſcandalous infectious priſon for the ſoldiery and for tranſport-convicts.

145 Somerſet-houſe. A little to the eaſtward ſtood *Somerſet houſe*, a palace built by Somerſet the Protector in the time of Edward VI.; and to make way for which he demoliſhed a great number of buildings without making any recompence to the owners. Part of the church of St John of Jeruſalem and the Tower were blown up for

London. the fake of the materials; and the cloiſters on the north ſide of St Paul's, with the charnel-houſe and chapel, underwent the ſame fate; the tombs being deſtroyed, and the bones thrown into Finſbury-fields. This happened in 1549; but it is probable that he did not live to inhabit the palace he built, as he was executed in the year 1552. After his death the palace fell to the crown; and it became an occaſional place of reſidence, firſt to Queen Elizabeth, and afterwards to Catherine queen to king Charles II. It was built in a ſtyle of architecture compounded of the Grecian and Gothic; and the back, front, and water-gate, were done from a deſign of Inigo Jones, about the year 1623. A chapel was begun the ſame year by that architect, and finiſhed ſome time after. The whole of this ſtructure was demoliſhed in 1775, in conſequence of an act of parliament; and a moſt magnificent edifice, from a deſign by Sir William Chambers, has been erected for the accommodation of all the public offices,—thoſe of the Treaſury, the Secretary of State, the Admiralty, the War, and the Exciſe, excepted. The Royal Society, and the Society of Antiquarians, hold their meetings here, in apartments which have been allotted to them by royal munificence; and here alſo are annually exhibited the works of the Britiſh painters and ſculptors. The terrace on the ſouth ſide is a walk bounded by the Thames, and unparalleled for grandeur and beauty of view.

146 St Martin's and other churches.

The church of St Martin is diſtinguiſhed by the name of *St Martin's in the Fields*, from its ſituation, which was formerly a field, with only a few ſcattered houſes. The church being decayed, was rebuilt by Henry VIII. and again by James I. but not being large enough to accommodate the inhabitants of the pariſh, it was augmented in 1607, at the charge of Prince Henry, eldeſt ſon of James I. and ſeveral of the nobility. After many expenſive reparations, however, it was entirely taken down in 1720, and a new church began, which was finiſhed in 1726. This is an elegant edifice, built of ſtone. On the weſt front is a noble portico of Corinthian columns, ſupporting a pediment, in which are repreſented the royal arms in bas relief. The aſcent to the portico is by a flight of very long ſteps. The length of this church is about 140 feet, the breadth 60, and height 45. It has a fine arched roof ſuſtained by ſtone columns of the Corinthian order. The ſteeple has a beautiful ſpire, and one of the beſt rings of bells in London.

St James's Church was built in the reign of Charles II. at the expence of Henry earl of St Alban's, and other neighbouring inhabitants. The building is of brick and ſtone, about 85 feet long, 60 broad, and 45 feet high, with a handſome ſteeple 150 feet in height.

St George's Church, near Hanover-ſquare, is a beautiful ſtructure. This was one of the fifty new churches erected within the bills of mortality, by act of parliament, in the reign of Queen Anne. The ground for the edifice was given by the late lieutenant-general Stewart, who alſo left 4000 l. to the pariſh, towards erecting and endowing a charity ſchool; which, by additional benefactions and ſubſcriptions, is become very conſiderable.

The greater part of the pariſh of *St Paul's Covent-garden*, was anciently a garden, belonging to the abbot and convent of Weſtminſter, and was then called *Convent-garden*, a name corrupted into Covent, and more generally Common-garden. In 1552, Edward VI. gave it to the earl of Bedford, with an adjoining field, formerly called the *Seven Acres*, but now, being turned into a long ſtreet, called *Long-acre*. The church of St Paul's, Covent-garden, was built by Inigo Jones, and is eſteemed one of the moſt ſimple and perfect pieces of architecture in England. In the front is a plain portico of the Tuſcan order, with maſſy columns. Before the church is a ſquare area, containing about three acres of ground, called *Covent-garden market*, and is the beſt in England for herbs, fruit, and flowers. On the north, and part of the eaſt ſide, is a magnificent piazza, deſigned by Inigo Jones. London. 147 Covent Garden.

148 St Mary le Strand, &c.

Next to the pariſh of St Paul, Covent-garden, is that of *St Mary le Strand*. This is alſo one of the fifty new churches built in the reign of Queen Anne, and is a handſome piece of architecture, though not very extenſive. At the entrance, on the weſt ſide, is an aſcent by a flight of ſteps, in a circular form, which leads to a ſimilarly ſhaped portico of Ionic columns, covered with a dome, that is crowned with a vaſe. The columns are continued along the body of the church, with pilaſters of the ſame order at the corners; and in the intercolumniations are niches handſomely ornamented. Over the dome is a pediment ſupported by Corinthian columns, which are alſo continued round the body of the ſtructure, over thoſe of the Ionic order. A handſome baluſtrade is carried round the top of the church, and adorned with vaſes.

A little eaſtward from the preceding church is that of *St Clement's Danes*, ſituated likewiſe in the Strand. A church is ſaid to have ſtood in this place ſince about the year 700; but the preſent ſtructure was begun in 1680, deſigned by Sir Criſtopher Wren. It is built of ſtone, with two rows of windows, the lower plain, but the upper ornamented; and the termination is by an attic, the pilaſters of which are covered with vaſes. On the ſouth ſide is a portico, covered with a dome, ſupported by Ionic columns; and oppoſite to this is another. The ſteeple is beautiful, and of a great height.

The *church of St George*, Bloomſbury, is alſo one of the fifty new churches erected by act of parliament. It is diſtinguiſhed from all the reſt by ſtanding ſouth and north, and by the ſtatue of King George I. at the top of its pyramidal ſteeple.

149 Foundling and other Hoſpitals.

In Lamb's Conduit-fields, on the north ſide of the town, is a large and commodious ſtructure called the *Foundling-hoſpital*, for the reception of expoſed and deſerted children. This laudable charity was projected by ſeveral eminent merchants in the reign of queen Anne; but was not carried into execution till many years afterwards, when a charter for its eſtabliſhment was obtained, through the indefatigable aſſiduity of Mr Thomas Coram, the commander of a merchant veſſel, who ſpent the remainder of his life in promoting this deſign. From the time of its inſtitution, the parliament has occaſionally granted conſiderable ſums for its ſupport; and in ſome years upwards of 6000 infants have been received.

Not far from hence is an *Hoſpital for the Small-pox*; and

London. and in different parts of the town there are others, either for the ſick of all kinds, or thoſe in particular circumſtances. Of the latter are ſeveral *Lying-in hoſpitals*, and the *Lock-hoſpital* for female patients in the venereal diſeaſe. Of the former are *St George's* and the *Middleſex hoſpitals*, beſides ſeveral infirmaries.

150 Gray's Inn. *Gray's Inn* is one of the four principal inns of court; which, though ſituated within the limits of the pariſh of St Andrew, Holborn, is yet without the liberties of the city of London. It took its name from an ancient family of the name of Gray, which formerly reſided here, and in the reign of Edward III. demiſed it to ſome ſtudents in the law; but it is ſaid to have been afterwards conveyed to the monks of Shene, near Richmond in Surry, who leaſed it to the ſociety of the Inn. It was held by this tenure till the diſſolution of the monaſteries, when Henry VIII. granted it to the ſociety in fee-farm. This inn conſiſts chiefly of two quadrangles, and has an old hall well built of timber, with a chapel in the Gothic ſtyle. Here is alſo a good library, and the Inn is accommodated with a ſpacious garden.

151 Lincoln's Inn. *Lincoln's-Inn*, another of the four principal inns of court, was originally the palace of Ralph Neville biſhop of Chicheſter, and chancellor of England about the year 1226. It afterwards devolved to the earl of Lincoln, who converted it into a court for the ſtudents of law about the year 1310. From him it received the name of Lincoln's-inn, and conſiſted only of what is now called the old ſquare, which is entered from Chancery-lane. At preſent this ſquare contains, beſides buildings for the lawyers, a large hall where the lord chancellor hears cauſes in the ſittings after term. To this inn belongs likewiſe a fine garden, which has lately been diminiſhed by the building of ſome large and commodious offices, for the uſe of the ſix clerks in the court of Chancery, &c.

152 Charter-houſe. In the pariſh of St James, Clerkenwell, is an hoſpital called the *Charter-houſe*, which is a corruption of the word *chartreux*, a name formerly uſed for a convent or priory of the Carthuſians, which this place formerly was. After the diſſolution of monaſteries it fell to the earl of Suffolk, who diſpoſed of it to Thomas Sutton, Eſq; a citizen of London, in the time of king James I. for L. 13,000. The purchaſer intending it for an hoſpital, applied to the king for a patent, which he obtained in 1611, and the grant was confirmed by parliament in 1623. Mr Sutton having expended L. 7000 in fitting up the buildings, gave it the name of king James's hoſpital, and endowed it with lands to the amount of near L. 4500 a-year, for the maintenance of 80 gentlemen, merchants or ſoldiers, who ſhould be reduced to indigent circumſtances; and 40 boys, to be inſtructed in claſſical learning. The men are provided with handſome apartments, and all the neceſſaries of life except clothes; inſtead of which each of them is allowed a gown, and L. 7 a-year. Of the boys, 29 are at a proper time ſent to the univerſity, where each has an allowance of L. 20 a-year for eight years. Others, who are judged more fit for trade, are put out apprentices, and the ſum of L. 40 is given with each of them. As a farther encouragement to the ſcholars, there are nine eccleſiaſtical preferments in the gift of the governors. It is alſo by the recommendation of the latter that all penſioners and youths are received into the hoſpital. They conſiſt of 16, of which number the king is always one, and the others are generally noblemen of the firſt rank. To this hoſpital belong a maſter, a preacher, two ſchoolmaſters, a phyſician, a regiſter, a receiver, a treaſurer, a ſteward, an auditor, and other officers; and the annual revenues of it being now increaſed to upwards of L. 6000, five men and four boys have been added to the original number. London.

153 Aſke's Hoſpital. In the pariſh of St Luke ſtands the Haberdaſhers alms-houſe, or *Aſke's Hoſpital*, ſo called from having been erected by the company of haberdaſhers, purſuant to the will of Robert Aſke, Eſq; one of their members, who left L. 30,000 for the building and the relief of 20 poor members of the company; beſides the maintenance and education of 20 boys, ſons of decayed freemen of the ſame company. This is a large edifice of brick and ſtone, 400 feet long, with a piazza in front 340 feet in length, conſiſting of ſtone columns of the Tuſcan order. In the middle of the building is a chapel, adorned with columns, entablatures, and pediment, of the Ionic order; and under the pediment is a niche, with a ſtatue of the founder. In the ſame pariſh is the Iron-mongers hoſpital, likewiſe a large building.

In the pariſh of St Mary, Whitechapel, ſtands the *London Hoſpital*, for the reception of the ſick. It is a large building, and was erected a few years ſince by voluntary contribution. Here are alſo ſome conſiderable alms-houſes.

154 Houſes of the Nobility. Within the precincts of Weſtminſter are ſeveral ſtately houſes belonging to the nobility, ſome of which have been already mentioned. Of the others, the moſt remarkakable at preſent are, Burlington-houſe, Devonſhire-houſe, Egremont-houſe, and Bedford-houſe; Carleton-houſe, the magnificent abode of the prince of Wales, and the ſuperb reſidence erected by the duke of York between the Treaſury and the Horſe-guards.

155 Britiſh Muſeum. To theſe may be added, *Montagu-houſe* (now the Britiſh Muſeum); which was built on a French plan by the firſt duke of Montagu, who had been ambaſſador in France. The ſtaircaſe and ceilings were painted by Rouſſeau and La Foſſe: the apotheoſis of Iris, and the aſſembly of the gods, are by the laſt. It was purchaſed of the duke's heirs by parliament, for uniting together the Royal, Cottonian, Harleian, Sloanian, and other collections of books, MSS. coins, antiquities, ſubjects in natural hiſtory, &c. &c. for the public uſe, for which it is excellently adapted. The firſt of theſe libraries contains the books and MSS. of our princes from Henry VII. to Charles II.; the ſecond the MSS. collected by Sir Robert Cotton, his ſon, and grandſon Sir John, which laſt gave it to the public by act 12 and 13 William III. c. 7. The Harleian collection of MSS. was formed by Edward earl of Oxford, and purchaſed by government in 1753, at the ſame time with the library, MSS. and natural curioſities of Sir Hans Sloane. This laſt coſt Sir Hans L. 50,000; and he left it, by will, to the uſe of the public, on condition that the parliament would pay L. 20,000 to his executors. It comprehends an amazing number of curioſities: among which are, the library, including books of drawings, MSS. and prints, amounting

London. amounting to about 50,000 volumes; medals and coins, ancient and modern, 20,000; cameos and intaglios, about 700; ſeals, 268; veſſels, &c. of agate, jaſper, &c. 542; antiquities, 1125; precious ſtones, agates, jaſper, &c. 2256; metals, minerals, ores, &c. 2725; cryſtal, ſpars, &c. 1864; foſſils, flints, ſtones, 1275; earths, ſands, ſalts, 1035; bitumens, ſulphurs, ambers, &c. 399; talcs, micæ, &c. 388; corals, ſpunges, &c. 1421; teſtacea, or ſhells, &c. 5843; echini, echinitæ, &c. 659; aſteriæi trochi, entrochi, &c. 241; cruſtaceæ, crabs, lobſters, &c. 363; ſtellæ marinæ, ſtar-fiſhes, &c. 173; fiſh, and their parts, &c. 1555; birds, and their parts, eggs, and neſts, of different ſpecies, 1172; quadrupeds, &c. 1886; vipers, ſerpents, &c. 521; inſects, &c. 5439; vegetables, 12,506; hortus ſiccus, or volumes of dried plants, 334; humani, as calculi, anatomical preparations, 756; miſcellaneous things, natural, 2098; mathematical inſtruments, 55. A catalogue of all the above is written in a number of large volumes. It is a large and magnificent building; and has behind it a garden, conſiſting nearly of nine acres.

156 Principal ſquares, &c.

Beſides a great number of ſpacious ſtreets, which are daily increaſing, this part of the metropolis is ornamented with ſeveral magnificent ſquares, viz. Groſvenor-ſquare, Berkeley-ſquare, Portman-ſquare, Cavendiſh-ſquare, Hanover-ſquare, St James's-ſquare, Soho-ſquare, Bloomſbury-ſquare, Queen's-ſquare, Lincoln's-Inn-fields, Leiceſter-ſquare, Red-Lion-ſquare, ſome of which have been particularly deſcribed; not to mention others that are at preſent building. In general, the new buildings in the liberty of Weſtminſter have increaſed to a prodigious degree; inſomuch that they reach as far as Marybone to the north, Piccadilly to the ſouth, and Hyde-Park-wall to the weſt.

157 London anciently inconvenient and unhealthy.

Before the conflagration in 1666, LONDON (which, like moſt other great cities, had ariſen from ſmall beginnings) was totally inelegant, inconvenient, and unhealthy, of which latter misfortune many melancholy proofs are authenticated in hiſtory, and which, without doubt, proceeded from the narrowneſs of the ſtreets, and the unaccountable projections of the buildings, that confined the putrid air, and joined with other circumſtances, ſuch as the want of water, rendered the city ſeldom free from peſtilential deva ſtation. The fire which conſumed the greateſt part of the city, dreadful as it was to the inhabitants at that time, was productive of conſequences which made ample amends for the loſſes ſuſtained by individuals; a new city aroſe on the ruins of the old; but, though more regular, open, convenient, and healthful, than the former, yet it by no means anſwered to the characters of magnificence or elegance, in many particulars; and it is ever to be lamented (ſuch was the infatuation of thoſe times), that the magnificent, elegant, and uſeful plan of the great Sir Chriſtopher Wren, was totally diſregarded, and ſacrificed to the mean and ſelfiſh views of private property; views which did irreparable injury to the citizens themſelves and to the nation in general: for had that great architect's plan been followed, what has often been aſſerted muſt have been the reſult; the metropolis of this kingdom would inconteſtably have been the moſt magnificent and elegant city in the univerſe, and of conſequence muſt, from the prodigious reſort of foreigners of diſtinction and taſte who would have viſited it, have become an inexhauſtible fund of riches to this nation. But as the deplorable blindneſs of that age has deprived us of ſo valuable an acquiſition, it is become abſolutely neceſſary that ſome efforts ſhould be made to render the preſent plan in a greater degree anſwerable to the character of the richeſt and moſt powerful people in the world. London.

158 Its plan ſtill defective.

The plan of London, in its preſent ſtate, will in many inſtances appear to very moderate judges to be as injudicious a diſpoſition as can eaſily be conceived for a city of trade and commerce, on the borders of ſo noble a river as the Thames. The wharfs and quays on its banks are extremely mean and inconvenient; and the want of regularity and uniformity in the ſtreets of the city of London, and the mean avenues to many parts of it, are alſo circumſtances that greatly leſſen the grandeur of its appearance. Many of the churches and other public buildings are likewiſe thruſt up in corners, in ſuch a manner as might tempt foreigners to believe that they were deſigned to be concealed. The improvements of the city of London for ſome years paſt have, however, been very great; and the new ſtreets, which are numerous, are in general more ſpacious, and built with greater regularity and elegance.

159 Great improvements.

The very elegant and neceſſary method of paving and enlightening the ſtreets is alſo felt in the moſt ſenſible manner by all ranks and degrees of people. The roads are continued for ſeveral miles around upon the ſame model; and, excluſive of lamps regularly placed on each ſide, at ſhort diſtances, are rendered more ſecure by watchmen ſtationed within call of each other. Nothing can appear more brilliant than thoſe lights when viewed at a diſtance, eſpecially where the roads run acroſs; and even the principal ſtreets, ſuch as Pall Mall, New Bond-ſtreet, Oxford-ſtreet, &c. convey an idea of elegance and grandeur.

160 Wealth and grandeur of this vaſt metropolis.

London, then, in its large ſenſe, including Weſtminſter, Southwark, and part of Middleſex, forms one great metropolis, of vaſt extent and of prodigious wealth. When conſidered with all its advantages, it is now what ancient Rome once was; the ſeat of liberty, the encourager of arts, and the admiration of the whole world. It is the centre of trade; has an intimate connection with all the counties in the kingdom; and is the grand mart of the nation, to which all parts ſend their commodities, from whence they are again ſent back into every town in the nation and to every part of the world. From hence innumerable carriages by land and water are conſtantly employed: and from hence ariſes that circulation in the national body which renders every part healthful, vigorous, and in a proſperous condition; a circulation that is equally beneficial to the head and the moſt diſtant members. Merchants are here as rich as noblemen; witneſs their incredible loans to government: and there is no place in the world where the ſhops of tradeſmen make ſuch a noble and elegant appearance, or are better ſtocked.

161 Its excellent ſituation for commerce.

The Thames, on the banks of which London is ſituated, is a river which, though not the largeſt, is the richeſt and moſt commodious for commerce of any in

London

in the world. It is continually filled with fleets, failing to or from the moſt diſtant climates: and its banks, from London-bridge to Blackwall, form almoſt one continued great magazine of naval ſtores; containing three large wet-docks, 32 dry-docks, and 33 yards for the building of ſhips for the uſe of the merchants; beſides the places allotted for the building of boats and lighters, and the king's yards lower down the river for the building of men of war. As the city is about 60 miles diſtant from the ſea, it enjoys, by means of this beautiful river, all the benefits of navigation, without the danger of being ſurpriſed by foreign fleets, or of being annoyed by the moiſt vapours of the ſea. It riſes regularly from the water-ſide, and, extending itſelf on both ſides along its banks, reaches a prodigious length from eaſt to weſt in a kind of amphitheatre towards the north, and is continued for near 20 miles on all ſides, in a ſucceſſion of magnificent villas and populous villages, the country-ſeats of gentlemen and tradeſmen; whither the latter retire for the benefit of freſh air, and to relax their minds from the hurry of buſineſs. The regard paid by the legiſlature to the property of the ſubject, has hitherto prevented any bounds being fixed for its extenſion.

162 Its great extent.

The irregular form of London makes it difficult to aſcertain its extent. However, its length from eaſt to weſt is generally allowed to be above ſeven miles from Hyde-park corner to Poplar; and its breadth in ſome places three, in others two, and in others again not much above half a mile. Hence the circumference of the whole is almoſt 18 miles; or, according to a later meaſurement, the extent of continued buildings is 35 miles two furlongs and 39 roods. But it is much eaſier to form an idea of the large extent of a city ſo irregularly built by the number of the people, who are computed to be near a million; and from the number of edifices devoted to the ſervice of religion.

163 General enumeration of churches chapels, &c.

Of theſe, beſide St Paul's cathedral and the collegiate church at Weſtminſter, here are 102 pariſh-churches, and 69 chapels, of the eſtabliſhed religion: 21 French proteſtant chapels; 11 chapels belonging to the Germans, Dutch, Danes, &c.; 26 independent meetings; 34 preſbyterian meetings; 20 baptiſt meetings; 19 popiſh chapels, and meeting-houſes for the uſe of foreign ambaſſadors and people of various ſects; and three Jews ſynagogues. So that there are 305 places devoted to religious worſhip in the compaſs of this vaſt pile of buildings, without reckoning the 21 out-pariſhes uſually included in the bills of mortality, and a great number of methodiſt tabernacles.

164 Hoſpitals, ſchools, houſes, &c.

There are alſo in and near this city 100 alms-houſes, about 20 hoſpitals and infirmaries, 3 colleges, 10 public priſons, 15 fleſh-markets; one market for live cattle; two other markets more particularly for herbs; and 23 other markets for corn, coals, hay, &c.; 15 inns of court, 27 public ſquares, beſides thoſe within ſingle buildings, as the Temple, &c.; 3 bridges, 55 halls for companies, 8 public ſchools, called free-ſchools; and 131 charity-ſchools, which provide education for 5034 poor children; 207 inns, 447 taverns, 551 coffeehouſes, 5975 alehouſes; 1000 hackney-coaches; 400 ditto chairs; 7000 ſtreets, lanes, courts, and alleys, and 150,000 dwelling-houſes, containing, as has been already obſerved, about 1,000,000 inhabitants;

165 Number of inhabitants.

who, according to a moderate eſtimate, are ſuppoſed to conſume the following proviſions weekly:

London.

	L.	*s.*	*d.*
1000 Bullocks, at 6l. a-piece	6000	0	0
6000 Sheep, at 12s. a-piece	3600	0	0
2000 Calves, at 1l. 4s. a-piece	2400	0	0
3000 Lambs, at 8s. a-piece, for ſix months	1200	0	0
1500 Hogs in pork and bacon, at 20s. for ſix months	1500	0	0
2000 Pigs, at 2s. 6d. a-piece	250	0	0
1000 Turkies, at 3s. 6d. a-piece, for ſix months	175	0	0
1000 Geeſe, at 2s. 6d. a-piece, for ſix months	125	0	0
2000 Capons, at 1s. 8d. a-piece	166	13	2
500 Dozens of Chickens at 9s. *per* dozen	225	0	0
4300 Ducks, at 9d. a-piece	161	5	0
1500 Dozen of rabbits, at 7s. *per* dozen, for eight months	525	0	0
2000 Dozen of pigeons, at 2s. *per* dozen, for eight months	200	0	0
700 Dozen of wild-fowl, of ſeveral ſorts, for ſix months	250	0	0
In ſalt and freſh fiſh, at 1d. a-day, for half a million of people for one week	14,583	6	8
In bread of all ſorts, white and brown at 1d. a-day, for one million of people for a week	29,166	13	4
300 Tons of wine, of all ſorts, at 50l. a ton, one ſort with another, for one week	15,000	0	0
In milk, butter, cheeſe, &c. at 1d. a-day, for a million of people for a week	29,166	13	4
In fruit of all ſorts, at one farthing a-day, for a million of people for a week	7291	13	4
In eggs of hens, ducks, geeſe, &c. at half a farthing a-day, for a million of people for a week	3645	16	4
In beer and ale, ſtrong and ſmall, at 2d. a-day, for a million of people for a week	58,333	6	8
In ſugar, plums, and ſpice, and all ſorts of grocery, at a halfpenny a-day, for a million of people for a week	14,583	6	8
In wheat-flour, for pies and puddings, oatmeal and rice, &c. at half a farthing a-day, for a million of people for a week	3645	16	8
In ſalt, oil, vinegar, capers, olives, and other ſauces, at half a farthing a-day, for a million of people for a week	3645	16	8
In roots and herbs of all ſorts, both for food and phyſic, at half a farthing a-day, for a million of people for a week	3645	11	8
In ſea-coal, charcoal, candles, and firewood, of all ſorts, at 1d. a-day, for a million of people for a week	29,166	13	4

166 Weekly conſumpt of proviſions.

In

London, Londonderry.

In paper of all ſorts (a great quantity being uſed in printing) quills, pens, ink, and wax, at a farthing a-day, for amillion of people for a week	7291	13	4
In tobacco, pipes, and ſnuff, at half a farthing a-day, for a million of people for a week	3645	16	8
In cloathing, as linen and woollen, for men, women, and children, ſhoes, ſtockings, &c. at 3s. 6d. *per* week, for a million of people for a week	175,000	0	0
Expences for horſe-meat, in hay, oats, beans, 1000 load of hay a-week, at 40s. a-load, comes to 2000l. in oats and beans the like value, 2000l. which is in all, for one week	4000	0	0
Cyder, mum, brandy, ſtrong waters, coffee, chocolate, tea, &c. at 1d. a-day, for a million of people for one week	29,166	13	4

167 Firing, porter, &c.

The common firing is pit-coal, commonly called *ſea-coal*, of which there are conſumed upwards of 766,880 chaldrons every year. The annual conſumption of oil in London and Weſtminſter for lamps, amounts to 400,000l. In 1787, the quantity of porter brewed in London for home-conſumption and foreign exportation, amounted to 1,176,856 barrels.

168 Supply of water.

This great and populous city is happily ſupplied with abundance of freſh water from the Thames and the New River; which is not only of inconceivable ſervice to every family, but by means of fire-plugs every where diſperſed, the keys of which are depoſited with the pariſh-officers, the city is in a great meaſure ſecured from the ſpreading of fire; for theſe plugs are no ſooner opened, than there are vaſt quantities of water to ſupply the engines. This plenty of water has been attended with another advantage, it has given riſe to ſeveral companies, who inſure houſes and goods from fire; an advantage that is not to be met with in any other nation on earth: the premium is ſmall, and the recovery in caſe of loſs is eaſy and certain. Every one of theſe offices keep a ſet of men in pay, who are ready at all hours to give their aſſiſtance in caſe of fire; and who are on all occaſions extremely bold, dexterous, and diligent: but though all their labours ſhould prove unſucceſsful, the perſon who ſuffers by this devouring element has the comfort that muſt ariſe from a certainty of being paid the value (upon oath) of what he has inſured.

169 Inſurance companies.

170 Places of diverſion, &c.

The places for diverſion are, Vauxhall, Ranelagh-gardens, the two play-houſes, one of them rebuilding, the Pantheon lately burnt down; and the little theatre in the Hay-market, with Sadlers-wells, Hughes's Circus, and Aſtley's Royal-Grove, &c. The fineſt repoſitories of rarities and natural hiſtory, are Sir Hans Sloane's, in the Britiſh Muſeum, already deſcribed; and another collected by the late Sir Aſhton Lever, now the private property of Mr Parkinſon, and depoſited in proper apartments for public inſpection, near the ſouth end of Blackfriars bridge.

LONDONDERRY, or COLERAIN, a county of Ireland, in the province of Ulſter. It is bounded on the ſouth and ſouth-weſt by the county of Tyronne; by Antrim on the eaſt, from which it is parted by the river Bann; by Donegal on the weſt; and that county and the Deucaledonian ocean on the north. Its greateſt length is about 36 miles, its breadth 30, containing about 251,510 acres. The bogs and heaths of this county are manured with ſea-ſhells, as thoſe of Donegal. Like that, too, it is pretty champaign, and not unfruitful. It is particularly noted for a very clear river called the *Bann*, abounding with ſalmon, a fiſh ſaid to delight in limpid ſtreams. This river, to diſtinguiſh it from a leſſer of the ſame name, is called the *Greater* or *Lower Bann*. In order to cultivate, ſettle, and civilize this county, king James I. granted it, by letters-patent, to a ſociety, by the name of the *Governor and Aſſiſtants at London of the new plantation of Ulſter in the realm of Ireland*. It contains ſix baronies; and, beſides the two knights of the ſhire, ſends to parliament two members for the city of Londonderry, and two each for Coleraine and Newton-Limavady or Lamnevady. Londonderry.

LONDONDERRY, or *Derry*, the capital of the county, and the ſee of a biſhop, ſtands at the bottom of Lough-Foyle. This city has a very good port, to which ſhips of the greateſt burden have acceſs, and a conſiderable trade. It will be ever famous for the gallantry and perſeverance with which it defended itſelf in three memorable ſieges, in defiance of the greateſt hardſhips and diſcouragements, namely, 1ſt, In 1641, when the rebels could not reduce it either by fraud or force. 2dly, In 1649, when it was beſieged by the Lord Ardes, and reduced almoſt to extremity by famine, till at laſt relieved by troops ſent from England. 3dly, When it held out againſt the French and Iriſh from the 7th of December 1688 to the laſt day of July 1689, though it was neither well fortified nor provided with a garriſon or ſtores of proviſion and ammunition, and hardly any attempt made to relieve it during ſo long a time. Though the city is 20 miles up the river, yet very large ſhips can come up to the quay, where there are four or five fathoms of water. It is now well fortified with a ſtrong wall, beſides outworks; and along the banks of the river are ſeveral caſtles and a fort. This city is of no great antiquity, having been built and planted in the reign of James I. by a colony ſent by the ſociety abovementioned. The trade of the town is very conſiderable, having not only a large ſhare in the herring-fiſhery, but ſending ſhips alſo to the Weſt-Indies, New-England, and Newfoundland, for which they are ſo advantageouſly ſituated, that a veſſel bound from thence to America often arrives there before a London ſhip can get clear of the ſoundings, or arrive in the latitude of Londonderry. Tho' there are a great many ſhallows in Lough-Foyle, which ſerve it inſtead of a road; yet they are eaſily avoided, as there are deep channels between them. Thoſe points called *Emiſtone*, *Ruſterhull*, or *Caldy-head*, which lie a little to the weſt of the mouth of the harbour, are counted the moſt northerly of Ireland, lying in lat. 55. 20. The inhabitants of this city are almoſt all Proteſtants. It gave title of *earl* and *baron* to a branch of the family of Pitt, which became extinct in 1764; but part of the title was revived in Robert Stewart, who was created Baron Londonderry in 1789. A late traveller ſays, "Derry is, perhaps,

Long. haps, the cleaneſt, beſt built, and moſt beautifully ſituated town in Ireland; and, excepting Corke, as convenient as any for commerce, foreign and domeſtic." The lake almoſt ſurrounds it; and the whole ground-plot both of it and its liberties belongs to the 12 great companies of London. Great quantities of ſalmon, ſalted and barrelled, are exported from hence to America.

LONG, an epithet given to whatever exceeds the uſual ſtandard of length.

Long-Boat, the largeſt and ſtrongeſt boat belonging to any ſhip. It is principally employed to carry great burdens, as anchors, cables, ballaſt, &c. See Boat.

LONG (Roger), D. D. maſter of Pembroke-hall in Cambridge, Lowndes's profeſſor of aſtronomy in that univerſity, rector of Cherryhinton in Huntingdonſhire, and of Bradwell *juxta mare* in Eſſex, was author of a well-known and much approved treatiſe of aſtronomy, and the inventor of a remarkably curious aſtronomical machine, thus deſcribed by himſelf. "I have, in a room lately built in Pembroke-hall, erected a ſphere of 18 feet diameter, wherein above 30 perſons may ſit conveniently; the entrance into it is over the ſouth pole by ſix ſteps; the frame of the ſphere conſiſts of a number of iron meridians, not complete ſemicircles, the northern ends of which are ſcrewed to a large round plate of braſs, with an hole in the centre of it; thro' this hole, from a beam in the cieling, comes the north pole, a round iron rod, about three inches long, and ſupports the upper parts of the ſphere to its proper elevation for the latitude of Cambridge; the lower part of the ſphere, ſo much of it as is inviſible in England, is cut off; and the lower or ſouthern ends of the meridians, or truncated ſemicircles, terminate on, and are ſcrewed down to, a ſtrong circle of oak, of about 13 feet diameter; which, when the ſphere is put into motion, runs upon large rollers of lignum vitæ, in the manner that the tops of ſome windmills are made to turn round. Upon the iron meridians is fixed a zodiac of tin painted blue, whereon the ecliptic and heliocentric orbits of the planets are drawn, and the conſtellations and ſtars traced: the Great and Little Bear and Draco are already painted in their places round the north pole; the reſt of the conſtellations are propoſed to follow: the whole is turned round with a ſmall winch, with as little labour as it takes to wind up a jack, though the weight of the iron, tin, and wooden circle, is about 1000 pounds. When it is made uſe of, a planetarium will be placed in the middle thereof. The whole, with the floor, is well ſupported by a frame of large timber." Thus far Dr Long, before this curious piece of mechaniſm was perfected. Since the above was written, the ſphere has been completely finiſhed; all the conſtellations and ſtars of the northern hemiſphere, viſible at Cambridge, are painted in their proper places upon plates of iron joined together, which form one concave ſurface. Dr Long publiſhed a Commencement Sermon 1728; and an anſwer to Dr Galley's pamphlet on Greek Accents; and died December 16th 1770, at the age of 91. As the materials for this article are ſcanty, we ſhall ſubjoin, from the Gentleman's Magazine †, a few traits of him, as delineated in 1769 by Mr Jones. "He is now in the 88th year of his age, and for his years vegete and active. He was lately (in October) put in nomination for the office of vice-chancellor. He executed that truſt once before, I think in the year 1737; a very ingenious perſon, and ſometimes very facetious. At the public commencement in the year 1713, Dr Greene (maſter of Bennet college, and afterwards biſhop of Ely) being then vice chancellor, Mr Long was pitched upon for the tripos-performance; it was witty and humorous, and has paſſed through divers editions. Some that remembered the delivery of it, told me, that in addreſſing the vice-chancellor (whom the univerſity wags uſually ſtyled *Miſs Greene*), the tripos-orator, being a native of Norfolk, and aſſuming the Norfolk dialect, inſtead of ſaying, *Domine Vice-Cancellarie*, did very archly pronounce the words thus, *Domina Vice-Cancellaria*; which occaſioned a general ſmile in that great auditory. His friend the late Mr Bonfoy of Ripton told me this little incident, 'That he and Dr Long walking together in Cambridge in a duſky evening, and coming to a ſhort *poſt* fixed in the pavement, which Mr B. in the midſt of chat and inattention, took to be a *boy* ſtanding in his way, he ſaid in a hurry, 'Get out of my way, boy.' '*That boy, Sir*,' ſaid the Doctor very calmly and ſlily, *is a* poſt-boy, *who turns out of his way for nobody*.'—I could recollect ſeveral other ingenious repartees if there were occaſion. One thing is remarkable, he never was a hale and hearty man, always of a tender and delicate conſtitution, yet took great care of it. His common drink water; he always dines with the fellows in the hall. Of late years he has left off eating fleſh-meats; in the room thereof, puddings, vegetables, &c. ſometimes a glaſs or two of wine."

† For 1783, p. 983.

LONGEVITY, length of life. Longevity.

From the different longevities of men in the beginning of the world, after the flood, and in theſe ages, Mr Derham draws an argument for the interpoſition of a divine Providence.

Immediately after the creation, when the world was to be peopled by one man and one woman, the ordinary age was 900 and upwards.—Immediately after the flood, when there were three perſons to ſtock the world, their age was cut ſhorter, and none of thoſe patriarchs, but Shem, arrived at 500. In the ſecond century we find none that reached 240: in the third, none but Terah that came to 200 years; the world, at leaſt a part of it, by that time being ſo well peopled, that they had built cities, and were cantoned out into diſtant nations.—By degrees, as the number of people increaſed, their *longevity* dwindled, till it came down at length to 70 or 80 years: and there it ſtood, and has continued to ſtand ever ſince the time of Moſes.—This is found a good medium, and by means hereof the world is neither overſtocked, nor kept too thin; but life and death keep a pretty equal pace.

That the common duration of man's life has been the ſame in all ages ſince the above period, is plain both from ſacred and profane hiſtory. To paſs by others, Plato lived to 81, and was accounted an old man: and the inſtances of *longevity* produced by Pliny L. vii. c. 48. as very extraordinary, may moſt of them be matched in modern hiſtories.—In the following Tables are collected into one point of view the moſt memorable inſtances of long-lived perſons of whoſe age

Longevity. we have any authentic records. The first and second are extracted from *Mr Whitehurst's Inquiry into the Origin and Strata of the Earth*, with some additions by Dr Fothergill; who inserted them, accompanied by a third, together with a number of useful observations, in the first volume of the Memoirs of the Manchester Literary Society. Longevity.

Names of the persons.	Ages	Places of Abode.	Living or Dead.
Thomas Parre	152	Shropshire	Died November 16. 1635. Phil. Trans. N° 44.
Henry Jenkins	169	Yorkshire	Died December 8. 1670. Phil. Trans. N° 221.
Robert Montgomery	126	Ditto	Died in — — 1670.
James Sands	140	Staffordshire	Do Fuller's Worthies p. 47: Raleigh's Hist. p. 166.
His Wife	120	Ditto	
Countess of Desmond	140	Ireland	
———Eclestone	143	Ditto	Died — — 1691. (A)
J. Sagar	112	Lancashire	—— — — 1668. (B)
—Laurence	140	Scotland	Living — — (C)
Simon Sack	141	Trionia	Died May 30. 1764.
Col. Thomas Winslow	146	Ireland	—— Aug. 26. 1766.
Francis Consist	150	Yorkshire	—— Jan. — 1768.
Christ. J. Drakenberg	146	Norway	—— June 24. 1770. (D)
Margaret Forster	136	Cumberland	Both living 1771.
——her daughter	104	Ditto	
Francis Bons	121	France	Died Feb. 6. 1769.
John Brookey	134	Devonshire	Living — — 1777. (E)
James Bowels	152	Killingworth	Died Aug. 15. 1656 (F)
John Tice	125	Worcestershire	—— March, 1774. (G)
John Mount	136	Scotland	—— Feb. 27. 1766. (H)
A. Goldsmith	140	France	—— June — 1776. (I)
Mary Yates	128	Shropshire	—— — — 1776. (K)
John Bales	126	Northampton	—— April 5. 1766. (L)
William Ellis	130	Liverpool	—— Aug. 16. 1780. (M)
Louisa Truxo, a Negress	175	Tucomea, S. America	Living Oct. 5. 1780. (N)
Margaret Patten	138	Lockneugh near Paisley	Lynche's Guide to Health
Janet Taylor	108	Fintray, Scotland	Died Oct. 10. 1780.
Richard Lloyd	133	Montgomery	Lynche's Guide to Health
Susannah Hilliar	100	Piddington, Northampsh.	Died Feb. 19. 1781 (O)
Ann Cockbolt	105	Stoke-Bruerne, *Ib.*	—— April 5. 1775 (P)
James Hayley	112	Middlewich, Cheshire	—— March 17. 1781 (Q)

William Walker, aged 112, not mentioned above, who was a soldier at the battle of Edge-hill.

If we look back to an early period of the Christian æra, we shall find that Italy has been, at least about that time, peculiarly propitious to longevity. Lord Bacon observes that the year of our Lord 76, in the reign of Vespasian, was memorable; for in that year was a taxing which afforded the most authentic method of knowing the ages of men. From it, there were found in that part of Italy lying between the Apennine mountains and the river Po 124 persons who either equalled or exceeded 100 years of age, namely:

54 persons of 100 Years each.			
57 - - 110			
2 - - 125			
		4 persons of	130 Years
		4 - -	136
		3 - -	140
	In Parma	3 - -	120
		2 - -	130
	In Brussels	1 - -	125
	In Placentia	1 - -	131
	In Faventia	1 - -	132
		6 - -	110
		4 - -	120
	In Rimino	1 - -	150 Years, *viz.* Marcus Aponsus.

Mr

(A) Fuller's Worthies, p. 140.
(B) Phil. Trans. abridged by Lowthorp, Vol. III. p. 30, 6.
(C) Derham's Physico-Theology, p. 173.
(D) Annual Register.
(E) Daily Advertiser, Nov. 18, 1777.
(F) Warwickshire.
(G) Daily Advertiser, March 1774.
(H) Morning Post, Feb. 29. 1776.
(I) Daily Advertiser, June 24. 1776.
(K) Daily Advertiser, Aug. 22. 1776.
(L) See Inscription in the portico of All-Saints church.
(M) London Even. Post, Aug. 22. 1780.
(N) London Chronicle, Oct. 5. 1780.
(O) Northamp. Mercury, Feb. 19. 1781.
(P) Well known to persons of credit of Northampton.
(Q) Gen. Evening Post, March 24. 1781.

Longevity. Mr Carew, in his ſurvey of Cornwall, aſſures us, that it is no unuſual thing with the inhabitants of that county to reach 90 years of age and upwards, and even to retain their ſtrength of body and perfect uſe of their ſenſes. Beſides Brown, the Corniſh beggar, who lived to 120, and one Polezew to 130 years of age, he remembered the deceaſe of four perſons in his own pariſh, the ſum of whoſe years, taken collectively, amounted to 340. Now, although longevity evidently prevails more in certain diſtricts than in others, yet it is by no means confined to any particular nation or climate; nor are there wanting inſtances of it, in almoſt every quarter of the globe, as appears from the preceding as well as the ſubſequent Tables; which might have been conſiderably enlarged, had it appeared neceſſary; but we have only added, in the laſt, three recent inſtances that are peculiarly remarkable. Longevity.

Names of the Perſons.	Age.	Places of Abode.	Where recorded.
Hippocrates, Phyſician	104	Iſland of Cos	Lynche on Health, chap. 3.
Democritus, Philoſopher	109	Abdera	Bacon's Hiſtory, 1095.
Galen, Phyſician	140	Pergamus	Voſſ. Inſt. or lib. 3.
Albuna, Marc	150	Ethiopia	Hakewell's Ap. lib. 1.
Dumitur Raduly	140	Haromſzeck, Tranſylvania	Died Jan. 18, 1782. Gen. Gazetteer, April 18th.
Titus Fullonius	150	Bononia	Fulgoſus, lib. 8.
Abraham Paiba	142	Charleſtown, South-Car.	General Gazetteer
L. Tertulla	137	Arminium	Bulgoſus lib. 8.
Lewis Cornaro	100	Venice	Bacon's Hiſt. of Life, p. 134.
Robert Blakeney, Eſq.	114	Armagh, Ireland	General Gazetteer.
Margaret Scott	125	Dalkeith, Scotland	Inſcrip. on her Tomb there.
W. Gulſtone	140	Ireland	Fuller's Worthies.
J. Bright	105	Ludlow	Lynche on Health.
William Poſtell	120	France	Bacon's Hiſtory, p. 134.
Jane Reeves	103	Eſſex	St J. Chron. June 14, 1781.
W. Paulet, Marquis of Wincheſter	106	Hampſhire	Baker's Chron. p. 502.
John Wilſon	116	Suffolk	Gen. Gaz. Oct. 29, 1782.
Patrick Wian	115	Leſbury, Northumberd.	Plemp. Fundammed, § 4. c. 8.
M. Laurence	140	Orcades	Buchanan's Hiſt. of Scot.
Evan Williams	145	Caermarthen work-houſe, ſtill alive	Gen. Gazetteer, Oct. 12, 1782.
John Jacobs (R)	121	Mount Jura	All the public prints, Jan. 1790.
Matthew Tait (S)	123	Auchinleck, Airſhire.	Died Feb. 19. 1792. Edin. Even. Cour. Mar. 8. 1792.
Donald Macleod (T)	104	Iſle of Sky. Alive Jan. 1792.	All the public prints at the end of 1790; and *Memoirs*, &c.

(R) This man, in 1789, at the age of 120, quitted his native hills, and from the ſummit of Mount Jura undertook a journey to Verſailles, to behold and return thanks to the National Aſſembly for the vote which had freed him and his poor countrymen from the feudal yoke. In the early part of his life, he was a ſervant in the family of the prince de Beaufremont. His memory continued good to the laſt day of his life; and the principal inconveniences which he felt from his great age were, that his ſight was weakened, and the natural heat of his body was ſo diminiſhed, that he ſhivered with cold in the middle of the dog-days if he was not ſitting by a good fire. This old man was received in the body of the houſe by the National Aſſembly, indulged with a chair, and directed to keep on his hat leſt he ſhould catch cold if he was to ſit uncovered. A collection was made for him by the members, which exceeded 500 l. Sterling; but he lived not to return to Mount Jura. He was buried on Saturday the 31ſt of January 1790, with great funeral pomp, in the pariſh-church of St Euſtace at Paris.

(S) He ſerved as a private at the taking of Gibraltar in 1704.

(T) *Memoirs of the Life and gallant Exploits of the Old Highlander Serjeant Donald Macleod*, &c. publiſhed Jan. 1791, in the 103d year of his age.—This old gentleman, for it appears that he really is a gentleman both by birth and by behaviour, was born in the year of the Revolution, in the pariſh of Bracadill, in the iſle of Sky and county of Inverneſs, North Britain. He is a cadet of the family of Uliniſh in Sky; and deſcended, through his mother, from Macdonald of Slate, the anceſtor of the preſent Lord Macdonald. The earlier part of his life coincided with the famine of ſeven years in Scotland; which was ſo great as to ſuggeſt, even to the patriotic Mr Fletcher, the idea of the people ſelling themſelves as ſlaves for immediate ſubſiſtence. He was bred in the midſt of want and hardſhips, cold, hunger, and for the years of his apprenticeſhip with a maſon and ſtone-cutter in Inverneſs, in inceſſant fatigue. He inliſted, when a boy, in the Scottiſh ſervice, in the town of Perth, in the laſt year of the reign of King William. The regiment into which he enliſted

Longevity. The Antediluvians are purpoſely omitted, as bearing too little reference to the preſent race of mortals, to afford any ſatisfactory concluſions; and as they have been already taken notice of in a ſeparate article; (ſee ANTEDILUVIANS). As the improbable ſtories of ſome perſons who have almoſt rivalled them in modern times, border too much upon the marvellous to find a place in theſe tables, the preſent examples are abundantly ſufficient to prove, that longevity does not depend, ſo much as has been ſuppoſed, on any particular climate, ſituation, or occupation in life: for we ſee, that it often prevails in places where all theſe are extremely diſſimilar; and it would, moreover, be very difficult, in the hiſtories of the ſeveral perſons above mentioned, to find any circumſtance common to them all, except, perhaps, that of being born of healthy parents, and of being inured to daily labour, temperance, and ſimplicity of diet. Among the inferior ranks of mankind, therefore, rather than among the ſons of eaſe and luxury, ſhall we find the moſt numerous inſtances of longevity; even frequently, when other external circumſtances ſeem extremely unfavourable: as in the caſe of the poor ſexton at Peterborough, who, notwithſtanding his unpromiſing occupation among dead bodies, lived long enough to bury two crowned heads, and to ſurvive two complete generations. The livelihood of Henry Jenkins and old Parre, is ſaid to have conſiſted chiefly of the coarſeſt fare, as they depended on precarious alms. To which may be added the remarkable inſtance of Agnes Milbourne, who, after bringing forth a numerous offſpring, and being obliged, through extreme indigence, to paſs the latter part of her life in St Luke's workhouſe, yet reached her 106th year in that ſordid and unfriendly ſituation. The plain diet and invigorating employments of a country life are acknowledged on all hands to be highly conducive to health and longevity, while the luxury and refinements of large cities are allowed to be equally deſtructive to the human ſpecies; and this conſideration alone, perhaps, more than counterbalances all the boaſted privileges of ſuperior elegance and civilization reſulting from a city life. Longevity.

From country villages, and not from crowded cities, have the preceding inſtances of longevity been chiefly ſupplied. Accordingly it appears, from the London bills of mortality, during a period of 30 years, viz. from the year 1728 to 1758, the ſum of the deaths amounted to 750,322, and that, in all this prodigious number, only 242 perſons ſurvived the 100th year of their age! This overgrown metropolis is computed by Dr Price to contain a ninth part of the inhabitants of England, and to conſume annually 7000 perſons, who remove into it from the country every year, without increaſing it. He moreover obſerves, that the number of inhabitants in England and Wales has diminiſhed about one-fourth part ſince the Revolution; and ſo rapidly of late, that in 11 years, near 200,000 of our common people have been loſt. If the calculation be juſt, however alarming it may appear in a national view, there is this conſolation, when conſidered in a philoſophical light, that without partial evil, there can be no general good; and that what a nation loſes in the ſcale of population at one period, it gains at another; and thus probably, the average number of inhabitants on the ſurface of the globe continues at all times nearly the ſame. By this medium, the world is neither overſtocked with inhabitants nor kept too thin, but life and death keep a tolerably equal pace. The inhabitants of this iſland, comparatively ſpeaking, are but as the duſt of the balance; yet inſtead of being diminiſhed, we are aſſured by other writers, that within theſe 30 years they are greatly increaſed.

The deſire of ſelf-preſervation, and of protracting the ſhort ſpan of life, is ſo intimately interwoven with our conſtitution, that it is juſtly eſteemed one of the firſt principles of our nature, and, in ſpite even of pain and miſery, ſeldom quits us to the laſt moments of our exiſtence. It ſeems, therefore, to be no leſs our duty than our intereſt, to examine minutely into the various

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was the Scots Royals, commanded by the earl of Orkney. That old military corps, at that time, uſed bows and arrows as well as ſwords, and wore ſteel caps. He ſerved in Germany and Flanders under the duke of Marlborough, under the duke of Argyle in the rebellion 1715, in the Highland Watch, or companies raiſed for enforcing the laws in the Highlands; in the ſame companies when, under the name of the 42d regiment, they were ſent abroad to Flanders, to join the army under the duke of Cumberland; in the ſame regiment in Ireland, and on the breaking out of the French war, 1757, in America. From the 42d he was draughted to act as a drill ſerjeant in the 78th regiment, in which he ſerved at the reduction of Louiſburg and Quebec: After this he became an out-penſioner of Chelſea Hoſpital. But ſuch was the ſpirit of this brave and hardy veteran, that he ſerved in 1761 as a volunteer in Germany under the marquis of Granby; and offered his ſervices in the American war to Sir Henry Clinton; who, though he declined to employ the old man in the fatigues and dangers of war, treated him with great kindneſs, allowed him a liberal weekly penſion out of his own pocket, and ſent him home in a ſhip charged with diſpatches to government.—The ſerjeant, "as his memory, according to the obſervation of his biographer, is impaired, does not pretend to make an exact enumeration of all his offspring: but he knows of 16 ſons now living, 14 of whom are in the army and navy, beſides daughters; the eldeſt of whom by his preſent wife is a mantuamaker in Newcaſtle.—His eldeſt ſon is now 83 years old, and the youngeſt only nine. Nor, in all probability, would this lad cloſe the rear of his immediate progeny, if his preſent wife, the boy's mother, had not attained to the 49th year of her age."—In his prime, he did not exceed five feet and ſeven inches. He is now inclined through age to five feet five inches. He has an intereſting phyſiognomy expreſſive of ſincerity, ſenſibility, and manly courage. His biographer very properly ſubmits it to the conſideration of the Polygraphic Society, whether they might not do a thing worthy of themſelves and their ingenious art, if they ſhould multiply likneſſes of this living antiquity, and circulate them at an eaſy rate throughout Britain and Europe. They would thus gratify a very general curioſity; a curioſity not confined to the preſent age.

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various means that have been conſidered as conducive to health and long life; and, if poſſible, to diſtinguiſh ſuch circumſtances as are eſſential to that great end from thoſe which are merely accidental. But here it is much to be regretted, that an accurate hiſtory of the lives of all the remarkable perſons in the above table, ſo far as relates to the diet, regimen, and the uſe of the non-naturals, has not been faithfully handed down to us; without which it is impoſſible to draw the neceſſary inferences. Is it not then a matter of aſtoniſhment, that hiſtorians and philoſophers have hitherto paid ſo little attention to longevity? If the preſent imperfect liſt ſhould excite others, of more leiſure and better abilities, to undertake a full inveſtigation of ſo intereſting a ſubject, the inquiry might prove not only curious but highly uſeful to mankind. In order to furniſh materials for a future hiſtory of longevity, the bills of mortality throughout the kingdom ought firſt to be reviſed, and put on a better footing, agreeable to the ſcheme of which Mancheſter and Cheſter have already given a ſpecimen highly worthy of imitation. The plan, however, might be further improved with very little trouble, by adding a particular account of the diet and regimen of every perſon who dies at 80 years of age or upwards; and mentioning whether his parents were healthy, long-lived people, &c. An accurate regiſter, thus eſtabliſhed throughout the Britiſh dominions, would be productive of many important advantages to ſociety, not only in a medical and philoſophical, but alſo in a political and moral view.

All the circumſtances that are moſt eſſentially neceſſary to life, may be compromiſed under the ſix following heads: 1. Air and climate; 2. Meat and drink; 3. Motion and reſt; 4. The ſecretions and excretions; 5. Sleep and watching; 6. Affections of the mind.

Theſe, though all perfectly natural to the conſtitution, have by writers been ſtyled the non-naturals, by a ſtrange perverſion of language; and have been all copiouſly handled under that improper term. However, it may not be amiſs to offer a few ſhort obſervations on each, as they are ſo immediately connected with the preſent ſubject.

1. *Air*, &c. It has long been known that freſh air is more immediately neceſſary to life than food; for a man may live two or three days without the latter, but not many minutes without the former. The vivifying principle contained in the atmoſphere, ſo eſſential to the ſupport of flame, as well as animal life, concerning which authors have propoſed ſo many conjectures, appears now to be nothing elſe but that pure dephlogiſticated fluid lately diſcovered by that ingenious philoſopher Dr Prieſtley. The common atmoſphere may well be ſuppoſed to be more or leſs healthy in proportion as it abounds with this animating principle. As this exhales in copious ſtreams from the green leaves of all kinds of vegetables, even from thoſe of the moſt poiſonous kind, may we not, in ſome meaſure, account why inſtances of longevity are ſo much more frequent in the country than in large cities; where the air, inſtead of partaking ſo largely of this ſalutary impregnation, is daily contaminated with noxious animal effluvia and phlogiſton?

With reſpect to climate, various obſervations conſpire to prove, that thoſe regions which lie within the temperate zones are beſt calculated to promote long life. Hence, perhaps, may be explained, why Italy has produced ſo many long livers, and why iſlands in general are more ſalutary than continents; of which Bermudas and ſome others afford examples. And it is a pleaſing circumſtance that our own iſland appears from the above table (notwithſtanding the ſudden viciſſitudes to which it is liable) to contain far more inſtances of longevity than could well be imagined. The ingenious Mr Whitehurſt aſſures us, from certain facts, that Engliſhmen are in general longer lived than North Americans; and that a Britiſh conſtitution will laſt longer, even in that climate, than a native one. But it muſt be allowed in general, that the human conſtitution is adapted to the peculiar ſtate and temperature of each reſpective climate, ſo that no part of the habitable globe can be pronounced too hot or too cold for its inhabitants. Yet, in order to promote a friendly intercourſe between the moſt remote regions, the Author of nature has wiſely enabled the inhabitants to endure great and ſurpriſing changes of temperature with impunity.

Longevity.

2. *Foods and drink.* Though foods and drink of the moſt ſimple kinds are allowed to be the beſt calculated for ſupporting the body in health, yet it can hardly be doubted but variety may be ſafely indulged occaſionally, provided men would reſtrain their appetites within the bounds of temperance; for bountiful Nature cannot be ſuppoſed to have poured forth ſuch a rich profuſion of proviſions, merely to tantalize the human ſpecies, without attributing to her the part of a cruel ſtep-dame, inſtead of that of the kind and indulgent parent. Beſides, we find, that by the wonderful powers of the digeſtive organs, a variety of animal and vegetable ſubſtances, of very diſcordant principles, are happily aſſimilated into one bland homogeneous chyle; therefore it ſeems natural to diſtruſt thoſe cynical writers, who would rigidly confine mankind to one ſimple diſh, and their drink to the mere water of the brook. Nature, it is true, has pointed out that mild inſipid fluid as the univerſal diluent, and therefore moſt admirably adapted for our daily beverage. But experience has equally proved, that vinous and ſpirituous liquors, on certain occaſions, are no leſs ſalutary and beneficial, whether it be to ſupport ſtrength againſt ſickneſs or bodily fatigue, or to exhilerate the mind under the preſſure of heavy misfortunes. But, alas! what Nature meant for innocent and uſeful cordials, to be uſed only occaſionally, and according to the direction of reaſon, cuſtom and caprice have, by degrees, rendered habitual to the human frame, and liable to the moſt enormous and deſtructive abuſes. Hence it may be juſtly doubted, whether gluttony and intemperance have not depopulated the world more than even the ſword, peſtilence, and famine. True, therefore, is the old maxim, "*Modus utendi ex veneno facit medicamentum, ex medicamento venenum.*"

3. and 4. *Motion and reſt, ſleep and watching* It is allowed on all hands, that alternate motion and reſt, and ſleep and watching, are neceſſary conditions to health and longevity; and that they ought to be adapted to age, temperament, conſtitution, temperature of the climate, &c.; but the errors which mankind daily commit in theſe reſpects become a fruitful ſource of diſeaſes. While ſome are bloated and relaxed with

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Longevity, Longford. ease and indolence, others are emaciated, and become rigid through hard labour, watching, and fatigue

5. *Secretions and excretions.* Where the animal functions are duly performed, the secretions go on regularly; and the different evacuations so exactly correspond to the quantity of aliment taken in, in a given time, that the body is found to return daily to nearly the same weight. If any particular evacuation happen to be preternaturally diminished, some other evacuation is proportionally augmented, and the equilibrium is commonly preserved; but continued irregularities, in these important functions, cannot but terminate in disease.

6. *Affections of the mind.* The due regulation of the passions, perhaps, contributes more to health and longevity than that of any other of the non-naturals. The animating passions, such as joy, hope, love, &c. when kept within proper bounds, gently excite the nervous influence, promote an equable circulation, and are highly conducive to health; while the depressing affections, such as fear, grief, and despair, produce the contrary effect, and lay the foundation of the most formidable diseases.

From the light which history affords us, as well as from some instances in the above table, there is great reason to believe, that longevity is in a great measure hereditary; and that healthy long-lived parents would commonly transmit the same to their children, were it not for the frequent errors in the non-naturals, which so evidently tend to the abbreviation of human life.

Where is it, but from these causes, and the unnatural modes of living, that, of all the children which are born in the capital cities of Europe, nearly one half die in early infancy? To what else can we attribute this extraordinary mortality? Such an amazing proportion of premature deaths is a circumstance unheard of among savage nations, or among the young of other animals! In the earliest ages, we are informed, that human life was protracted to a very extraordinary length; yet how few persons, in these latter times, arrive at that period which nature seems to have designed! Man is by nature a field-animal, and seems destined to rise with the sun, and to spend a large portion of his time in the open air, to inure his body to robust exercises and the inclemency of the seasons, and to make a plain homely repast only when hunger dictates. But art has studiously defeated the kind intentions of nature; and by enslaving him to all the blandishments of sense, has left him, alas! an easy victim to folly and caprice. To enumerate the various abuses which take place from the earliest infancy, and which are continued through the succeeding stages of modish life, would carry us far beyond our present intention. Suffice it to observe, that they prevail more particularly among people who are the most highly polished and refined. To compare their artificial mode of life with that of nature, or even with the long-livers in the list, would probably afford a very striking contrast; and at the same time supply an additional reason why, in the very large cities, instances of longevity are so very rare.

LONGFORD, a county of Ireland, in the province of Leinster, bounded by the county of Leitrim and Caven on the north, Meath on the east and south, and Roscommon on the west. It contains 134,700 Irish plantation acres, 24 parishes, 6 baronies, and 4 boroughs; and returns 10 members to parliament. It is small, and much encumbered with bog, intermixed with a tolerable good soil; and is about 25 miles long and 15 broad. Longford ‖ Longing.

LONGFORD, a town of Ireland, situated on the river Cromlin, in the county of Longford and province of Leinster, 64 miles from Dublin; which river falls a few miles below this place into the Shannon. It is a borough, post, market, and fair town; and returns two members to parliament; patron, Lord Longford. It gave title of *earl* to the family of Aungier; of *viscount*, to the family of Micklethwaite; and now gives that of *baron* to the family of Packenham. Within a mile and a half of the town is a charter-school for above 40 children. This place has a barrack for a troop of horse. It is large and well built; and in a very early age an abbey was founded here, of which St Idus, one of St Patrick's disciples, was abbot. In the year 1400, a fine monastery was founded to the honour of the Virgin Mary, for Dominican friars, by O'Ferral prince of Annaly. This monastery being destroyed by fire, Pope Martin V. by a bull in the year 1429, granted an indulgence to all who should contribute to the rebuilding of it. In 1433, Pope Eugene IV. granted a bull to the same purpose; and in 1438 he granted another to the like effect. The church of this friary, now the parish-church, is in the diocese of Ardagh. The fairs are four in the year.

LONG-ISLAND, is an island of North America, belonging to the state of New-York, which is separated from the continent by a narrow channel. It extends from the city of New-York east 140 miles, terminating with Montauk point; and is not more than 10 miles in breadth on a medium. It is divided into three counties, King's, Queen's, and Suffolk. The south side of the island is flat land, of a light sandy soil, bordered on the sea-coast with large tracts of salt meadow, extending from the west point of the island to Southampton. This soil, however, is well calculated for raising grain, especially Indian corn. The north side of the island is hilly, and of a strong soil, adapted to the culture of grain, hay, and fruit. A ridge of hills extends from Jamaica to South-hold. Large herds of cattle feed upon Hampstead plain and on the salt marshes upon the south side of the island. Hampstead plain in Queen's county is a curiosity. It is 16 miles in length, east and west, and 7 or 8 miles wide. The soil is black, and to appearance rich and yet it was never known to have any natural growth, but a kind of wild grass and a few shrubs. It is frequented by vast numbers of plover. Rye grows tolerably well on some parts of the plain. The most of it lies common for cattle, horses, and sheep. As there is nothing to impede the prospect in the whole length of this plain, it has a curious but tiresome effect upon the eye, not unlike that of the ocean. The island contains 30,863 inhabitants.

LONGIMETRY, the art of measuring lengths, both accessible and inaccessible. See GEOMETRY and TRIGONOMETRY.

LONGING, is a preternatural appetite in pregnant women, and in some sick persons when about to recover. It is called *pica*, from the bird of that name, which is said to be subject to the same disorder. The disorder

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Longinico, Longinus.

consists of both a desire of unusual things to eat and drink, and in being soon tired of one and wanting another. It is called *malaci*, from μαλακία, "weakness." In pregnant women it is somewhat relieved by bleeding, and in about the fourth month of their pregnancy it leaves them. Chlorotic girls, and men who labour under suppressed hemorrhoids, are very subject to this complaint, and are relieved by promoting the respective evacuations. In general, whether this disorder is observed in pregnant women, in persons recovering from an acute fever, or in those who labour under obstructions of the natural evacuations, this craving of the appetite should be indulged.

LONGINICO, a town of Turky in Europe, in the Morea, anciently called *Olympia*, famous for being the place where the Olympic games were celebrated, and for the temple of Jupiter Olympus, about a mile distant. It is now but a small place, seated on the river Alpheus, 10 miles from its mouth, and 50 south of Lepanto. E. Long. 22. 0. N. Lat. 37. 30.

LONGINUS (Dionysius), a celebrated Greek critic of the third century, was probably an Athenian. His father's name is unknown, but by his mother he was allied to the celebrated Plutarch. His youth was spent in travelling with his parents, which gave him an opportunity to increase his knowledge, and improve his mind. After his travels, he fixed his residence at Athens, and with the greatest assiduity applied to study. Here he published his Treatise on the Sublime; which raised his reputation to such a height, and gave the Athenians such an opinion of his judgment and taste, that they made him sovereign judge of all authors, and every thing was received and rejected by the public according to his decisions. He seems to have staid at Athens a long time; here he taught the academic philosophy, and among others had the famous Porphyry for his pupil. But it was at length his fortune to be drawn from Athens, and to mix in more active scenes; to train up young princes to virtue and glory; to guide the busy passions of the great to noble objects; to struggle for, and at last to die, in the cause of liberty. Zenobia, queen of the East, prevailed on him to undertake the education of her sons; and he soon gained an uncommon share in her esteem: she spent the vacant hours of her life in his conversation, and modelled her sentiments and conduct by his instructions. That princess was at war with Aurelian; and being defeated by him near Antioch, was compelled to shut herself up in Palmyra, her capital city. The emperor wrote her a letter, in which he ordered her to surrender; to which she returned an answer, drawn up by Longinus, which filled him with resentment. The emperor laid siege to the city; and the Palmyrians were at length obliged to open their gates and receive the conqueror. The Queen and Longinus endeavoured to fly into Persia; but were unhappily overtaken and made prisoners when they were on the point of crossing the Euphrates. The Queen, intimidated, weakly laid the blame of vindicating the liberty of her country on its true author; and the brave Longinus, to the disgrace of the conqueror, was carried away to immediate execution. The writings of Longinus were numerous, some on philosophical, but the greater part on critical subjects. Dr Pearce has collected the titles of 25 treatises, none of which, excepting that on the Sublime, have escaped the depredations of time and barbarians. On this imperfect piece the great fame of Longinus is raised, who, as Pope expresses it—"is himself the great sublime he draws." The best edition of his works is that by Tollius, printed at Utrecht in 1694, *cum notis variorum*. It has been translated into English by Mr Smith.

Longissimus, Longitude.

LONGISSIMUS DORSI. See ANATOMY, *Table of the Muscles*.

LONGITUDE, in geography and navigation, is the distance of any place from another eastward or westward, counted in degrees upon the equator; but when the distance is reckoned by leagues or miles and not in degrees, or in degrees on the meridian, and not of the parallel of latitude, in which case it includes both latitude and longitude, it is called *departure*.

To find the longitude at sea, is a problem to which the attention of navigators and mathematicians has been drawn ever since navigation began to be improved.—The importance of this problem soon became so well known, that, in 1598, Philip III. of Spain offered a reward of 1000 crowns for the solution; and his example was soon followed by the States General, who offered 10,000 florins. In 1714 an act was passed in the British parliament, impowering certain commissioners to make out a bill for a sum not exceeding 2000 l. for defraying the necessary expences of experiments for ascertaining this point; and likewise granting a reward to the person who made any progress in the solution, proportionable to the degree of accuracy with which the solution was performed: 10,000 l. was granted if the longitude should be determined to one degree of a great circle, or 60 geographical miles; 15,000 if to two thirds of that distance; and 20,000 if to the half the distance.

In consequence of these proffered rewards, innumerable attempts were made to discover this important secret. The first was that of John Morin professor of mathematics at Paris, who proposed it to Cardinal Richelieu; and though it was judged insufficient on account of the imperfection of the lunar tables, a pension of 2000 livres *per annum* was procured for him in 1645 by Cardinal Mazarine. Gemma Frisius had indeed, in 1530, projected a method of finding the longitude by means of watches, which at that time were newly invented: but the structure of these machines was then by far too imperfect to admit of any attempt; nor even in 1631, when Metius made an attempt to this purpose, were they advanced in any considerable degree. About the year 1664, Dr Hooke and Mr Huygens made a very great improvement in watchmaking, by the application of the pendulum spring. Dr Hooke having quarrelled with the ministry, no experiment was made with any of his machines; but many were made with those of Mr Huygens. One experiment, particularly, made by Major Holmes, in a voyage from the Coast of Guinea in 1665, answered so well, that Mr Huygens was encouraged to improve the structure of his watches; but it was found that the variations of heat and cold produced such alterations in the rate of going of the watch, that unless this could be remedied, the watches could be of little use in determining the longitude.

In 1714 Henry Sully, an Englishman, printed a small tract at Vienna upon the subject of watch-

making,

Longitude. making. Having afterwards removed to Paris, he applied himſelf to the improvement of time-keepers for the diſcovery of the longitude. He taught the famous Julian de Roy; and this gentleman, with his ſon, and M. Berthoud, are the only perſons who, ſince the days of Sully, have turned their thoughts this way. But though experiments have been made at ſea with ſome of their watches, it does not appear that they have been able to accompliſh any thing of importance with regard to the main point. The firſt who ſucceeded in any conſiderable degree was Mr John Harriſon; who, in 1726, produced a watch which went ſo exactly, that for ten years together it did not err above one ſecond in a month. In 1736 it was tried in a voyage to Liſbon and back again, on board one of his Majeſty's ſhips; during which it corrected an error of a degree and an half in the computation of the ſhip's reckoning. In conſequence of this he received public encouragement to go on; and by the year 1761 had finiſhed three time-keepers, each of them more accurate than the former. The laſt turned out ſo much to his ſatisfaction, that he now applied to the commiſſioners of longitude for leave to make an experiment with his watch in a voyage to the Weſt Indies. Permiſſion being granted, his ſon Mr William Harriſon ſet out in his Majeſty's ſhip the Deptford for Jamaica in the month of November 1761. This trial was attended with all imaginable ſucceſs. The longitude of the iſland, as determined by the time-keeper, differed from that found by aſtronomical obſervations only one minute and a quarter of the equator; the longitudes of places ſeen by the way being alſo determined with great exactneſs. On the ſhip's return to England, it was found to have erred no more during the whole voyage than 1′ 54½″ in time, which is little more than 28 miles in diſtance; which being within the limits preſcribed by the act, the inventor claimed the whole L. 20,000 offered by government. Objections to this, however, were ſoon ſtarted. Doubts were pretended about the real longitude of Jamaica, as well as the manner in which the time had been found both there and at Portſmouth. It was alleged alſo, that although the time-keeper happened to be right at Jamaica, and after its return to England, this was by no means a proof that it had always been ſo in the intermediate times; in conſequence of which allegations, another trial was appointed in a voyage to Barbadoes. Precautions were now taken to obviate as many of theſe objections as poſſible. The commiſſioners ſent out proper perſons to make aſtronomical obſervations at that iſland; which, when compared with others in England, would aſcertain beyond a doubt its true ſituation. In 1764 then, Mr Harriſon junior ſet ſail for Barbadoes; and the reſult of the experiment was, that the difference of longitude betwixt Portſmouth and Barbadoes was ſhown by the time-keeper to be 3h. 55′ 3″; and by aſtronomical obſervations to be 3h. 54′ 20″; the error being now only 43″ of time, or 10′ 45″ of longitude. In conſequence of this and the former trials, Mr Harriſon received one half of the reward promiſed, upon making a diſcovery of the principles upon which his time-keepers were conſtructed. He was likewiſe promiſed the other half of the reward as ſoon as time-keepers ſhould be conſtructed by other artiſts which ſhould anſwer the purpoſe as well as thoſe of Mr Harriſon himſelf. At this time he delivered up all his time-keepers, the laſt of which was ſent to Greenwich to be tried by Mr Nevil Maſkelyne the aſtronomer-royal. On trial, however, it was found to go with much leſs regularity than had been expected; but Mr Harriſon attributed this to his having made ſome experiments with it which he had not time to finiſh when he was ordered to deliver up the watch. Soon after this, an agreement was made by the commiſſioners with Mr Kendall to conſtruct a watch upon Mr Harriſon's principles; and this upon trial was found to anſwer the purpoſe even better than any that Harriſon himſelf had conſtructed. This watch was ſent out with Captain Cook in 1772; and during all the time of his voyage round the world in 1772, 1773 1774, and 1775, never erred quite 14⅟₂ ſeconds per day: in conſequence of which, the houſe of commons, in 1774, ordered the other L. 10,000 to be paid to Mr Harriſon. Still greater accuracy, however, has been attained. A watch was lately conſtructed by Mr Arnold, which, during a trial of 13 months, from February 1779 to February 1780, varied no more than 6.69″ during any two days; and the greateſt difference between its rates of going on any day and the next to it was 4.11." The greateſt error it would have committed therefore in the longitude during any ſingle day would have been very little more than one minute of longitude; and thus might the longitude be determined with as great exactneſs as the latitude generally can.—This watch, however, has not yet been tried at ſea. Longitude.

Thus the method of conſtructing time-keepers for diſcovering the longitude ſeems to be brought to as great a degree of perfection as can well be expected. Still, however, as theſe watches are ſubject to accidents, and may thus alter the rate of their going without any poſſibility of a diſcovery, it is neceſſary that ſome other method ſhould be fallen upon, in order to correct from time to time thoſe errors which may ariſe either from the natural going of the watch, or from any accident which may happen to it. Methods of this kind are all founded upon celeſtial obſervations of ſome kind or other; and for theſe methods, or even for an improvement in time-keepers, rewards are ſtill held out by government. After the diſcoveries made by Mr Harriſon, the act concerning the longitude was repealed, excepting ſo much of it as related to the conſtructing, printing, publiſhing, &c. of nautical almanacks and other uſeful tables. It was enacted alſo, that any perſon who ſhall diſcover a method for finding the longitude by means of a time-keeper, the principles of which have not hitherto been made public, ſhall be intitled to a reward of L. 5000, if, after certain trials made by the commiſſioners, the ſaid method ſhall enable a ſhip to keep her longitude during a voyage of ſix months within 60 geographical miles or a degree of a great circle. If the ſhip keeps her longitude within 40 geographical miles for that time, the inventor is intitled to a reward of L. 7500, and to L 10,000 if the longitude is kept within half a degree. If the method is by improved aſtronomical tables, the author is intitled to L. 5000 when they ſhow the diſtance of the moon from the ſun and ſtars within 15 ſeconds of a degree, anſwering to about 7 minutes of longitude, after allowing half a degree for

errors

Longitude. errors of obſervation, and under certain reſtrictions, and after compariſon with aſtronomical obſervations for a period of 18½ years, during which the lunar irregularities are ſuppoſed to be completed. The ſame rewards are offered to the perſon who ſhall with the like accuracy diſcover any other method of finding the longitude. Longitude.

Theſe methods require celeſtial obſervations; and any of the phenomena, ſuch as the different apparent places of ſtars with regard to the moon, the beginning and ending of eclipſes, &c. will anſwer the purpoſe: only it is abſolutely neceſſary that ſome variation ſhould be perceptible in the phenomenon in the ſpace of two minutes; for even this ſhort ſpace of time will produce an error of 30 miles in longitude. The moſt proper phenomena therefore for determining the longitude in this manner are the eclipſes of Jupiter's ſatellites. Tables of their motions have been conſtructed, and carefully corrected from time to time, as the mutual attractions of theſe bodies are found greatly to diſturb the regularity of their motions. The difficulty here, however, is to obſerve theſe eclipſes at ſea; and this difficulty has been found ſo great, that no perſon ſeems able to ſurmount it. The difficulty ariſes from the violent agitation of a ſhip in the ocean, for which no adequate remedy has ever yet been found, nor probably will ever be found. Mr Chriſtopher Irwin indeed invented a machine which he called a *marine chair*, with a view to prevent the effects of this agitation; but on trying it in a voyage to Barbadoes, it was found to be totally uſeleſs.

A whimſical method of finding the longitude was propoſed by Meſſrs Whiſton and Ditton from the report and flaſh of great guns. The motion of ſound is known to be nearly equable, from whatever body it proceeds or whatever be the medium. Suppoſing therefore a mortar to be fired at any place the longitude of which is known, the difference between the moment that the flaſh is ſeen and the report heard will give the diſtance between the two places; whence, if we know the latitudes of theſe places, their longitudes muſt alſo be known. If the exact time of the exploſion be known at the place where it happens, the difference of time at the place where it is heard will likewiſe give the difference of longitude. Let us next ſuppoſe the mortar to be loaded with an iron ſhell filled with combuſtible matter, and fired perpendicularly upward into the air, the ſhell will be carried to the height of a mile, and will be ſeen at the diſtance of near 100; whence, ſuppoſing neither the flaſh of the mortar ſhould be ſeen nor the report heard, ſtill the longitude might be determined by the altitude of the ſhell above the horizon.

According to this plan, mortars were to be fired at certain times and at proper ſtations along all frequented coaſts for the direction of mariners. This indeed might be of uſe, and in ſtormy weather might be a kind of improvement in light-houſes, or a proper addition to them; but with regard to the determination of longitudes, is evidently ridiculous.

We ſhall now proceed to give ſome practical directions for finding the longitude at ſea by proper celeſtial obſervations; excluſive of thoſe from Jupiter's Satellites, which, for reaſons juſt mentioned, cannot be practiſed at ſea. In the firſt place, however, it will be neceſſary to point out ſome of thoſe difficulties which ſtand in the way, and which render even this method of finding the longitude precarious and uncertain. Theſe lie principally in the reduction of the obſervations of the heavenly bodies made on the ſurface of the earth to ſimilar obſervations ſuppoſed to be made at the centre; which is the only place where the celeſtial bodies appear in their proper ſituation. It is alſo very difficult to make proper allowances for the refraction of the atmoſphere, by which all objects appear higher than they really are; and another difficulty ariſes from their parallaxes, which makes them, particularly the moon, appear lower than they would otherwiſe do, excepting when they are in the very zenith. It is alſo well known, that the nearer the horizon any celeſtial body is, the greater its parallax will be; and as the parallax and refraction act in oppoſite ways to one another, the former depreſſing and the latter raiſing the object, it is plain, that great difficulties muſt ariſe from this circumſtance. The ſun, for inſtance, whoſe parallax is leſs than the refraction, muſt always appear higher than he really is; but the moon, whoſe parallax is greater than her refraction, muſt always appear lower.

To render obſervations of the celeſtial bodies more eaſy, the commiſſioners of longitude have cauſed an Ephemeris or Nautical Almanack to be publiſhed annually, containing every requiſite for ſolving this important problem which can be put into the form of tables. But whatever may be done in this way, it will be neceſſary to make the neceſſary preparations concerning the dip of the horizon, the refraction, ſemediameters, parallax, &c. in order to reduce the apparent to the true altitudes and diſtances; for which we ſhall here ſubjoin two general rules.

The principal obſervation for finding the longitude at ſea is that of the moon from the ſun, or from ſome remarkable ſtar near the zodiac. To do this, the operator muſt be furniſhed with a watch which can be depended upon for keeping time within a minute for ſix hours; and with a good Hadley's quadrant, or, which is preferable, a ſextant: and this laſt inſtrument will ſtill be more fit for the purpoſe if it be furniſhed with a ſcrew for moving the index gradually; likewiſe an additional dark glaſs, but not ſo dark as the common kind, for taking off the glare of the moon's light in obſerving her diſtance from a ſtar. A ſmall teleſcope, which may magnify three or four times, is alſo neceſſary to render the contact of a ſtar with the moon's limb more diſcernible. A magnifying glaſs of 1½ or 2 inches focus will likewiſe aſſiſt the operator in reading off his obſervations with the greater facility.

1. *To make the obſervation.* Having examined and adjuſted his inſtrument as well as poſſible, the obſerver is next to proceed in the following manner: If the diſtance of the moon from the ſun is to be obſerved, turn down one of the ſcreens; look at the moon directly through the tranſparent part of the horizon-glaſs; and keeping her in view, gently move the index till the ſun's image be brought into the ſilvered part of that glaſs. Bring the neareſt limbs of both objects into contact, and let the quadrant librate a little on the lunar ray; by which means the ſun will appear to riſe and fall by the ſide of the moon; in which motion the neareſt limbs muſt be made to touch one another exactly by moving the index. The ob-

Longitude. servation is then made; and the diviſion coinciding with that on the Vernier ſcale, will ſhow the diſtance of the neareſt limbs of the objects.

When the diſtance of the moon from a ſtar is to be obſerved when the moon is very bright, turn down the lighteſt ſcreen, or uſe a dark glaſs lighter than the ſcreens, and deſigned for this particular purpoſe; look at the ſtar directly through the tranſparent part of the horizon-glaſs; and keeping it there, move the index till the moon's image is brought into the ſilvered part of the ſame glaſs. Make the quadrant librate gently on the ſtar's ray, and the moon will appear to riſe and fall by the ſtar: move the index between the librations, until the moon's enlightened limb is exactly touched by the ſtar, and then the obſervation is made. In theſe operations, the plane of the quadrant muſt always paſs through the two objects, the diſtance of which is to be obſerved; and for this purpoſe it muſt be placed in various poſitions according to the ſituation of the objects, which will ſoon be rendered eaſy by practice.

The obſervation being made, ſomebody at th every inſtant that the operator calls muſt obſerve by the watch the exact hour, minute, and quarter minute, if there be no ſecond hand, in order to find the apparent time; and at the ſame inſtant, or as quick as poſſible, two aſſiſtants muſt take the altitudes of thoſe objects the diſtance of which is obſerved; after which, the obſervations neceſſary for finding the longitude are completed.

The ephemeris ſhows the moon's diſtance from the ſun, and likewiſe from proper ſtars, to every three hours of apparent time for the meridian of Greenwich; and that the greater number of opportunities of obſerving this luminary may be given, her diſtance is generally ſet down from at leaſt one object on each ſide of her. Her diſtance from the ſun is ſet down while it is between 40 and 120 degrees; ſo that, by means of a ſextant, it may be obſerved for two or three days after her firſt and before her laſt quarter. When the moon is between 40 and 90 degrees from the ſun, her diſtance is ſet down both from the ſun and from a ſtar on the contrary ſide; and, laſtly, when the diſtance is above 120 degrees, the diſtance is ſet down from two ſtars, one on each ſide of her. The diſtance of the moon from objects on the eaſt ſide of her is found in the ephemeris in the 8th and 9th pages of the month; and her diſtance from objects on the weſt is found in the 10th and 11th pages of the month.

When the ephemeris is uſed, the diſtance of the moon muſt only be obſerved from thoſe ſtars the diſtance of which is ſet down there; and theſe afford a ready means of knowing the ſtar from which her diſtance ought to be obſerved. The obſerver has then nothing more to do than to ſet his index to the diſtance roughly computed at the apparent time, eſtimated nearly for the meridian at Greenwich; after which he is to look to the eaſt or weſt of the moon, according as the diſtance of the ſtar is found in the 8th or 9th, or in the 10th or 11th, pages of the month; and having found the moon upon the horizon-glaſs, the ſtar will eaſily be found by ſweeping with the quadrant to the right or left, provided the air be clear and the ſtar be in the line of the moon's ſhorteſt axis produced. The time at Greenwich is eſtimated by turning into time the ſuppoſed longitude from that place, and adding it to the apparent time at the ſhip, or ſubtracting it from it as occaſion requires. Longitude. The diſtance of the moon from the ſun, or a ſtar, is roughly found at this time, by ſaying, As 180 minutes (the number contained in three hours) is to the difference in minutes between this nearly eſtimated time and the next preceding time ſet down in the ephemeris; ſo is the difference in minutes between the diſtances in the ephemeris for the next preceding and next following times, to a number of minutes; which being added to the next preceding diſtance, or ſubtracted from it, according as it is increaſing or decreaſing, will give the diſtance nearly at the time the obſervation is to be made, and to which the index muſt be ſet.

An eaſier method of finding the angular diſtance is by bringing the objects nearly into contact in the common way, and then fixing the index tight to a certain degree and minute; waiting until the objects are nearly in contact, giving notice to the aſſiſtants to get ready with the altitudes, and when the objects are exactly in contact to call for the altitudes and the exact time by the watch. The obſerver may then prepare for taking another diſtance, by ſetting his index three or four minutes backwards or forwards, as the objects happen to be receding from or approaching to each other; thus proceeding to take the diſtance, altitudes, and time by the watch, as before. Thus the obſerver may take as many diſtances as he thinks proper; but four at the diſtance of three minutes, or three at the diſtance of four minutes, will at all times be ſufficient. Thus not only the eye of the obſerver will be leſs fatigued, but he will likewiſe be enabled to manage his inſtrument with much greater facility in every direction, a vertical one only excepted. If in taking the diſtances the middle one can be taken at any even diviſion on the arch, ſuch as a degree, or a degree and 20 or 40 minutes, that diſtance will be independent of the Nonius diviſion, and conſequently free of thoſe errors which frequently ariſe from the inequality of that diviſion in ſeveral parts of the graduated arch. The obſervation ought always to be made about two hours before or after noon; and the true time may be found by the altitude of the ſun taken at the preciſe time of the diſtance. If three diſtances are taken, then find the time by the altitude correſponding with the middle diſtance; and thus the obſervation will be ſecured from any error ariſing from the irregularity of the going of the watch. As the time, however, found by the altitude of a ſtar cannot be depended upon, becauſe of the uncertainty of the horizon in the night, the beſt way of determining the time for a night obſervation will be by two altitudes of the ſun; one taken on the preceding afternoon, before he is within ſix degrees of the horizon; and the other on the next morning, when he is more than ſix degrees high. It muſt be obſerved, however, that in order to follow theſe directions, it is neceſſary that the atmoſphere ſhould be pretty free from clouds; otherwiſe the obſerver muſt take the obſervations at ſuch times as he can beſt obtain them.

2. *To reduce the obſerved Diſtance of the Sun or a Star from the moon to the true Diſtance.* 1. Turn the longitude into time, and add it to the time at the ſhip if the longitude be weſt, but ſubtract it if it be eaſt, which

Longitude.

which will give the ſuppoſed time at Greenwich; and this we may call *reduced time*. 2. Find the neareſt noon or midnight both before and after the reduced time in the ſeventh page of the month in the ephemeris. 3. Take out the moon's ſemidiameter and horizontal parallaxes correſponding to theſe noons and midnights, and find their differences. Then ſay, As 12 hours is to the moon's ſemidiameter in 12 hours, ſo is the reduced time to a number of ſeconds; which, either added to or ſubtracted from the moon's ſemidiameter at the noon or midnight juſt mentioned, according as it is increaſing or decreaſing, will give her apparent ſemidiameter; to which add the correction from Table VIII. of the ephemeris, and the ſum will be her true ſemidiameter at the reduced time. And as 12 hours is to the difference of the moon's horizontal parallax in 12 hours, ſo is the reduced time to a fourth number; which, being added to or ſubtracted from the moon's horizontal parallax at the noon or midnight before the reduced time, according as it is increaſing or decreaſing, the ſum or difference will be the moon's horizontal parallax at the reduced time. 4. If the reduced time be nearly any even part of 12 hours, *viz* $\frac{1}{6}$th, $\frac{1}{4}$th, &c. theſe parts of the difference may be taken, and either added or ſubtracted according to the directions already given, without being at the trouble of working by the rule of proportion. 5. To the obſerved altitude of the ſun's lower limb add the difference betwixt his ſemidiameter and dip; and that ſum will be his apparent altitude. 6. From the ſun's refraction take his parallax in altitude, and the remainder will be the correction of the ſun's altitude. 7. From the ſtar's obſerved altitude take the dip of the horizon, and the remainder will be the apparent altitude. 8. The refraction of a ſtar will be the correction of its altitude. 9. Take the difference between the moon's ſemidiameter and dip, and add it to the obſerved altitude if her lower limb was taken, or ſubtract it if her upper limb was taken; and the ſum or difference will be the apparent altitude of her centre. 10. From the proportional logarithm of the moon's horizontal parallax, taken out of the nautical almanack (increaſing its index by 10), take the logarithmic coſine of the moon's apparent altitude, the remainder will be the proportional logarithm of her parallax in altitude; from which take her refraction, and the remainder will be the correction of the moon's altitude. 11. To the obſerved diſtance of the moon from a ſtar add her ſemidiameter if the neareſt limb be taken, but ſubtract it if the fartheſt limb was taken, and the ſum or difference will be the apparent diſtance. 12. To the obſerved diſtance of the ſun and moon add both their ſemidiameters, and the ſum will be the apparent diſtance of their centres.

3. *To find the true Diſtance of the Objects, having their apparent Altitudes and Diſtances.* 1. To the proportional logarithm of the correction of the ſun or ſtar's altitude, add the logarithmic coſine of the ſun or ſtar's apparent altitude; the logarithmic ſine of the apparent diſtance of the moon from the ſun or ſtar; and the logarithmic co-ſecant of the moon's apparent altitude. The ſum of theſe, rejecting 30 from the index, will be the proportional logarithm of the firſt angle. 2. To the proportional logarithm of the correction of the ſun or ſtar's altitude, add the logarithmic co-tangent of the ſun or ſtar's apparent altitude, and the logarithmic tangent of the apparent diſtance of the moon from the ſun or ſtar. The ſum of theſe, rejecting 20 in the index, will be the proportional logarithm of the ſecond angle. 3. Take the difference between the firſt and ſecond angles, adding it to the apparent diſtance if it be leſs than 90, and the firſt angle be greater than the ſecond; but ſubtracting it if the ſecond be greater than the firſt. If the diſtance be greater than 90, the ſum of the angles muſt be added to the apparent diſtance, which will give the diſtance corrected for the refraction of the ſun or ſtar. 4. To the proportional logarithm of the correction of the moon's altitude add the logarithmic coſine of her apparent altitude; the logarithmic ſine of the diſtance corrected for the ſun or ſtar's refraction, and the logarithmic co-ſecant of the ſun or ſtar's apparent altitude. The ſum, rejecting 30 in the index, will be the proportional logarithm of the third angle. 5. To the proportional logarithm of the correction of the moon's apparent altitude, add the logarithmic co-tangent of her apparent altitude, and the tangent of the diſtance corrected for the ſun or ſtar's refraction; their ſum, rejecting 20 in the index, will be the proportional logarithm of the fourth angle. 6. Take the difference between the third and fourth angles, and ſubtract it from the diſtance corrected for the ſun or ſtar's refraction if leſs than 90, and the third angle be greater than the fourth; or add it to the diſtance if the fourth angle be greater than the third: but if the diſtance be more than 90, the ſum of the angles muſt be ſubtracted from it, to give the diſtance corrected for the ſun or ſtar's refraction, and the principal effects of the moon's parallax. 7. In Table XX. of the ephemeris, look for the diſtance corrected for the ſun and ſtar's refraction, and the moon's parallax in the top column, and the correction of her altitude in the left-hand ſide column; take out the number of ſeconds that ſtand under the former, and oppoſite to the latter. Look again in the ſame table for the corrected diſtance in the top column, and the correction of the moon's altitude in the left-hand ſide column; take out the number of ſeconds that ſtand under the former and oppoſite to the latter. Look again in the ſame table for the corrected diſtance in the top-column, and the correction of the moon's altitude in the left-hand ſide column; take out the number of ſeconds that ſtand under the former, and oppoſite to the latter. Look again in the ſame table for the corrected diſtance in the top-column, and the principal effects of the moon's parallax in the left-hand ſide column, and take out the number of ſeconds. The difference between theſe two numbers muſt be added to the corrected diſtance if leſs than 90, but ſubtracted from it if greater; and the ſum or difference will be the true diſtance.

4. *To determine the Longitude after having obtained the true Diſtance.* Look in the ephemeris among the diſtances of the objects for the computed diſtance betwixt the moon and the other object obſerved on the given day. If it be found there, the time at Greenwich will be at the top of the column; but if it falls between two diſtances in the ephemeris which ſtand immediately before and after it, and alſo the difference between the diſtance ſtanding before and

Longitude. the computed distance; then take the proportional logarithms of the first and second differences, and the difference between these two logarithms will be the proportional logarithm of a number of hours, minutes, and seconds; which being added to the time standing over the first distance, will give the true time at Greenwich. Or it may be found by saying, As the first difference is to three hours, so is the second difference to a proportional part of time; which being added as above directed, will give the time at Greenwich. The difference between Greenwich time and that at the ship, turned into longitude, will be that at the time the observations were made; and will be east if the time at the ship is greatest, but west if it is least.

Having given these general directions, we shall next proceed to show some particular examples of finding the longitude at sea by all the different methods in which it is usually tried.

1. *To find the Longitude by Computation from the Ship's Course.*—Were it possible to keep an accurate account of the distance the ship has run, and to measure it exactly by the log † or any other means, then both latitude and longitude would easily be found by settling the ship's account to that time. For the course and distance being known, the difference of latitude and departure is readily found by the Traverse Table; and the difference of longitude being known, the true longitude and latitude will also be known. A variety of causes, however, concur to render this computation inaccurate; particularly the ship's continual deflection from the course set by her playing to the right and left round her centre of gravity; the unequal care of those at the helm, and the distance supposed to be sailed being erroneous, on account of stormy seas, unsteady winds, currents, &c. for which it seems impossible to make any allowance. The place of the ship, however, is judged of by finding the latitude every day, if possible, by observations; and if the latitude found by observation agrees with that by the reckoning, it is presumed that the ship's place is properly determined; but if they disagree, it is concluded that the account of the longitude stands in need of correction, as the latitude by observation is always to be depended upon.

† See *Log* (perpetual)

Currents very often occasion errors in the computation of a ship's place. The causes of these in the great depths of the ocean are not well known, though many of the motions near the shore can be accounted for. It is supposed that some of those in the great oceans are owing to the tide following the moon, and a certain libration of the waters arising from thence; likewise that the unsettled nature of these currents may be owing to the changes in the moon's declination. In the torrid zone, however, a considerable current is occasioned by the trade-winds, the motion being constantly to the west, at the rate of eight or ten miles per day. At the extremities of the trade-winds or near the 30th degree of north or south latitude, the currents are probably compounded of this motion to the westward, and of one towards the equator; whence all ships sailing within these limits ought to allow a course each day for the current.

When the error is supposed to have been occasioned by a current, it ought if possible to be tried whether the case is so or not; or we must make a reasonable estimate of its drift and course. Then with the setting and drift, as a course and distance, find the difference of latitude and departure; with which the dead reckoning is to be increased or diminished: and if the latitude thus corrected agrees with that by observation, the departure thus corrected may be safely taken as true, and thus the ship's place with regard to the longitude determined. Longitude.

Exam. Suppose a ship in 24 hours finds, by her dead reckoning, that she has made 96 miles of difference of latitude north and 38 miles of departure west; but by observation finds her difference of latitude 112, and on trial that there is a current which in 24 hours makes a difference of 16 miles latitude north and 10 miles of departure east: Required the ship's departure.

	miles.		miles.
Diff. lat. by account	96 N.	Departure by account	38 W.
Diff. lat. by current	16 N.	Departure by current	10
True diff. lat.	112		28 W.

Here the dead reckoning corected by the current gives the difference of latitude 112 miles, which is the same as that found by observation; whence the departure 28 is taken as the true one.

When the error is supposed to arise from the courses and distances, we must observe, that if the difference of latitude is much more than the departure, or the direct course has been within three points of the meridian, the error is most probably in the distance. But if the departure be much greater than the difference of latitude, or the direct course be within three points of the parallel, or more than five points from the meridian, the error is probably to be ascribed to the course. But if the courses in general are near the middle of the quadrant, the error may be either in the course, or in the distance, or both. This method admits of three cases.

1. When, by the dead reckoning, the difference of latitude is more than once and an half the departure; or when the course is less than three points: Find the course to the difference of latitude and departure. With this course and the meridional difference of latitude by observation, find the difference of longitude.

2. When the dead reckoning is more than once and an half the difference of latitude; or when the course is more than five points: Find the course and distance with the difference of latitude by observation, and departure by account; then with the co-middle latitude by observation, and departure by account, find the difference of longitude.

3. When the difference of latitude and departure by account is nearly equal, or the direct course is between three and five points of the meridian: Find the course with the difference of latitude and departure by account since the last observation. With this course and the difference of latitude by observation find another departure. Take half the sum of these departures for the true one. With the true departure and difference of latitude by observation find the true course; then with the true course and meridional difference of latitude find the difference of longitude.

2. *To find the Longitude at Sea by a Variation-chart.*—

Longitude. Dr Halley having collected a great number of obſervations on the variation of the needle in many parts of the world; by that means was enabled to draw certain lines on Mercator's chart, ſhowing the variation in all the places over which they paſſed in the year 1700, at which time he firſt publiſhed the chart; whence the longitude of thoſe places might be found by the chart provided its latitude and variation was given. The rule is, Draw a parallel of latitude on the chart through the latitude found by obſervation; and the point where it cuts the curved line marked with the variation that was obſerved will be the ſhip's place.

Exam. A ſhip finds by obſervation the latitude to be 18° 20′ north; and the variation of the compaſs to be 4° weſt. Required the ſhip's place.—Lay a ruler over 18° 20′ north parallel to the equator; and the point where its edge cuts the curve of 4° weſt variation gives the ſhip's place, which will be found in about 27° 10′ weſt from London.

This method of finding the longitude, however, is attended with two inconveniences. 1. That when the variation lines run eaſt or weſt, or nearly ſo, it cannot be applied; though as this happens only in certain parts of the world, a variation chart may be of great uſe for the reſt. Even in thoſe places indeed where the variation curves do run eaſt or weſt, they may be of conſiderable uſe in correcting the latitude when meridian obſervations cannot be had; which frequently happens on the northern coaſts of America, the Weſtern Ocean, and about Newfoundland; for if the variation can be found exactly, the eaſt and weſt curve anſwering to it will ſhow the latitude. But, 2. The variation itſelf is ſubject to continual change; whence a chart, though ever ſo perfect at firſt, muſt in time become totally uſeleſs; and hence the charts conſtructed by Dr Halley, though of great utility at their firſt publication, became at length almoſt entirely uſeleſs. A new one was publiſhed in 1746 by Meſſrs Mountaine and Dodſon, which was ſo well received, that in 1756 they again drew variation lines for that year, and publiſhed a third chart the year following. They alſo preſented to the Royal Society a curious paper concerning the variation of the magnetic needle, with a ſet of tables annexed, containing the reſult of more than 50,000 obſervations, in ſix periodical reviews from the year 1700 to 1756 incluſive, adapted to every five degrees of latitude and longitude in the more frequented oceans; all of which were publiſhed in the Philoſophical Tranſactions for 1757.

3. *To find the Longitude by the Sun's Declination.*—Having made ſuch obſervations on the ſun as may enable us to find his declination at the place, take the difference between this computed declination and that ſhown at London by the ephemeris; from which take alſo the daily difference of declination at that time; then ſay, as the daily difference of declination is to the above found difference, ſo is 360 degrees to the difference of longitude. In this method, however, a ſmall error in the declination will make a great one in longitude.

4. *To find the Longitude by the Moon's culminating.*—Seek in the ephemeris for the time of her coming to the meridian on the given day and on the day following, and take their difference; alſo take the difference betwixt the times of culminating on the ſame day as found in the ephemeris, and as obſerved; then ſay, as the daily difference in the ephemeris is to the difference between the ephemeris and obſervation; ſo is 360 degrees to the difference of longitude. In this method alſo a ſmall difference in the culmination will occaſion a great one in the longitude. Longitude.

5. *By Eclipſes of the Moon.*—This is done much in the ſame manner as by the eclipſes of Jupiter's ſatellites: For if, in two or more diſtant places where an eclipſe of the moon is viſible, we carefully obſerve the times of the beginning and ending, the number of digits eclipſed, or the time when the ſhadow touches ſome remarkable ſpot, or when it leaves any particular ſpot on the moon, the difference of the times when the obſervations were made will give the difference of longitude. Phenomena of this kind, however, occur too ſeldom to be of much uſe.

6. In the 76th volume of the Philoſophical Tranſactions, Mr Edward Pigot gives a very particular account of his method of determining the longitude and latitude of York; in which he alſo recommends the method of determining the longitude of places by obſervations of the *moon's tranſit over the meridian*. The inſtruments uſed in his obſervations were a gridiron pendulum-clock, a two feet and an half reflector, an eighteen inch quadrant made by Mr Bird, and a tranſit inſtrument made by Mr Siſſon.

By theſe inſtruments an obſervation was made, on the 10th of September 1783, of the occultation of a ſtar of the ninth magnitude by the moon, during an eclipſe of that planet, at York and Paris. Beſides this, there were obſervations made of the immerſions of ♀ *Aquarii* and ♂ *Piſcium*; the reſult of all which was, that between Greenwich and York the difference of meridians was 4′ 27″.

In 1783, Mr Pigot informs us, that he thought of finding the difference of meridians by obſerving the meridian right aſcenſions of the moon's limb. This he thought had been quite original: but he found it afterwards in the Nautical Almanack for 1769, and in 1784 read a pamphlet on the ſame ſubject by the Abbé Toaldo; but ſtill found that the great exactneſs of this method was not ſuſpected; though he is convinced that it muſt ſoon be univerſally adopted in preference to that from the firſt ſatellite of Jupiter.

After giving a number of obſervations on the ſatellites of Jupiter, he concludes, that the exactneſs expected from obſervations, even on the firſt ſatellite, is much over-rated. "Among the various objections (ſays he), there is one I have often experienced, and which proceeds ſolely from the diſpoſition of the eye, that of ſeeing more diſtinctly at one time than another. It may not be improper alſo to mention, that the obſervation I ſhould have relied on as the beſt, that of Aug. 30. 1785, marked *excellent*, is one of thoſe moſt diſtant from the truth."

After giving a number of obſervations on the eclipſe of the moon Sept. 10. 1783, our author concludes, that the eclipſes of the moon's ſpots are in general too much neglected, and that it might be relied upon much more were the following circumſtances attended to: 1. To be particular in ſpecifying the clearneſs of the ſky. 2. To chooſe ſuch ſpots as are well defined, and leave no heſitation as to the part eclipſed. 3. That every obſerver ſhould uſe, as far as poſſible, teleſcopes

equally

Longitude. equally powerful, or at leaſt let the magnifying powers be the ſame. "A principal objection (ſays he) may ſtill be urged, viz. the difficulty of diſtinguiſhing the true ſhadow from the penumbra. Was this obviated, I believe the reſults would be more exact than from Jupiter's firſt ſatellite: Undoubtedly the ſhadow appears better defined if magnified little; but I am much inclined to think, that, with high magnifying powers, there is greater certainty of chooſing the ſame part of the ſhadow, which perhaps is more than a ſufficient compenſation for the loſs of diſtinctneſs."

The following rule for meridian obſervations of the moon's limb is next laid down: "The increaſe of the moon's right aſcenſion in twelve hours (or any given time found by computation), is to 12 hours as the increaſe of the moon's right aſcenſion between two places found by obſervation is to the difference of meridians.

Example.

Nov. 30. 1782.

h.	′	″		
13	12	57.62	Meridian tranſit of moon's ſecond limb	By clock at Greenwich.
13	13	29.08	Ditto of α ♍	
		31.46	Difference of right aſcenſion.	
13	14	8.05	Meridian tranſit of moon's ſecond limb	By clock at York.
13	14	30.13	Ditto of α ♍	
		22.08	Difference at York.	The clocks going nearly ſidereal time, no correction is required.
		31.46	Difference at Greenwich.	
		9.38	Increaſe of the moon's apparent right aſcenſion between Greenwich and York, by obſervation.	

141″ in ſeconds of a degree, ditto, ditto, ditto.

The increaſe of the moon's right aſcenſion for 12 hours, by computation, is 23,340 ſeconds; and 12 hours reduced into ſeconds is 43,200. Therefore, according to the rule ſtated above,

23,340″ : 43,200″ : diff. of merid. = 261″.

"Theſe eaſy obſervations and ſhort reduction (ſays Mr Pigott) are the whole of the buſineſs. Inſtead of computing the moon's right aſcenſion for 12 hours, I have conſtantly taken it from the Nautical Almanacks, which give it ſufficiently exact, provided ſome attention be paid to the increaſe or decreaſe of the moon's motion. Were the following circumſtances attended to, the reſults would be undoubtedly much more exact.

"1. Compare the obſervations with the ſame made in ſeveral other places. 2. Let ſeveral and the ſame ſtars be obſerved at theſe places. 3. Such ſtars as are neareſt in right aſcenſion and declination to the moon are infinitely preferable. 4. It cannot be too ſtrongly urged to get, as near as poſſible, an equal number of obſervations of each limb, to take a mean of each ſet, and then a mean of both means. This will in a great meaſure correct the error of teleſcopes and ſight. 5. The adjuſtment of the teleſcopes to the eye of the obſerver before the obſervation is alſo very neceſſary, as the ſight is ſubject to vary. 6. A principal error proceeds from the obſervation of the moon's limb, which may be conſiderably leſſened, if certain little round ſpots near each limb were alſo obſerved in ſettled obſervatories; in which caſe the libration of the moon will perhaps be a conſideration. 7. When the difference of meridians, or of the latitudes of places, is very conſiderable, the change of the moon's diameter becomes an equation. Longitude.

"Though ſuch are the requiſites to uſe this method with advantage, only one or two of them have been employed in the obſervations that I have reduced. Two-thirds of theſe obſervations had not even the ſame ſtars obſerved at Greenwich and York; and yet none of the reſults, except a doubtful one, differ 15″ from the mean; therefore I think we may expect a ſtill greater exactneſs, perhaps within 10″ if the above particulars be attended to.

"When the ſame ſtars are not obſerved, it is neceſſary for the obſervers at both places to compute their right aſcenſion from tables, in order to get the apparent right of aſcenſion of the moon's limb. Though this is not ſo ſatisfactory as by actual obſervation, ſtill the difference will be trifling, provided the ſtar's right aſcenſions are accurately ſettled. I am alſo of opinion, that the ſame method can be put in practice by travellers with little trouble, and a tranſit inſtrument, conſtructed ſo as to fix up with facility in any place. It is not neceſſary, perhaps, that the inſtrument ſhould be perfectly in the meridian for a few ſeconds of time, provided ſtars, nearly in the ſame parallel of declination with the moon, are obſerved; nay, I am inclined to think, that if the inſtrument deviates even a quarter or half a degree, or more, ſufficient exactneſs can be attained; as a table might be computed, ſhowing the moon's parallax and motion for ſuch deviation; which laſt may eaſily be found by the well known method of obſerving ſtars whoſe difference of declination is conſiderable.

"As travellers very ſeldom meet with ſituations to obſerve ſtars near the pole, or find a proper object for determining the error of the line of collimation, I ſhall recommend the following method as original.—Having computed the apparent right aſcenſion of four, ſix, or more ſtars, which have nearly the ſame parallel of declination, obſerve half of them with the inſtrument inverted, and the other half when in its right poſition. If the difference of right aſcenſions between each ſet by obſervation agrees with the computation, there is no error; but if they diſagree, half that diſagreement is the error of the line of collimation. The ſame obſervations may alſo ſerve to determine, whether the diſtance of the correſponding wires are equal. In caſe of neceſſity, each limb of the ſun might be obſerved in the ſame manner, though probably with leſs preciſion. By a ſingle trial I made above two years ago, the reſult was much more exact than I expected. Mayor's catalogue of ſtars will prove of great uſe to thoſe that adopt the above method.—I am rather ſurpriſed that the immerſions of known ſtars of the ſixth and ſeventh magnitude, behind the dark limb of the moon, are not conſtantly obſerved in fixed obſervatories, as they would frequently be of great uſe."

The

Longitude. The annexed rule for finding the ſhip's place, with the miſcellaneous obſervations on different methods, we have been favoured with by Mr John M'Lean of the Obſervatory, Edinburgh. The rule was examined and approved of by Sir Joſeph Banks preſident of the Royal Society.

1. With regard to determining the ſhip's place by the help of the courſe and diſtance ſailed, the following rule may be applied.—It will be found as expeditious as any of the common methods by the middle latitude or meridional parts; and is in ſome reſpects preferable, as the common tables of ſines and tangents only are requiſite in applying it.—Let *a* and *b* be the diſtances of two places from the ſame pole in degrees, or their complete latitudes; *c* the angle which a meridian makes with the rhumb line paſſing through the places; and L the angle formed by their meridians, or the difference of longitude in minutes: then A and B being the logarithmic tangents of $\frac{1}{2}a$ and $\frac{1}{2}b$, S the ſine of C, and S′ the ſine of (C+1′), we ſhall have the following equation $L=\frac{A\backsim B}{S'-S}$ (A). Alſo, from a well known property of the rhumb line, we have the following equation:

S+E=R+D, where S is the logarithmic coſine of C, E the logarithm of the length of the rhumb-line, or diſtance, D the logarithm of the minute's difference of latitude, and R the logarithm of the radius.

By the help of theſe two equations, we ſhall have an eaſy ſolution of the ſeveral caſes to which the middle latitude, or meridional parts, are commonly applied.

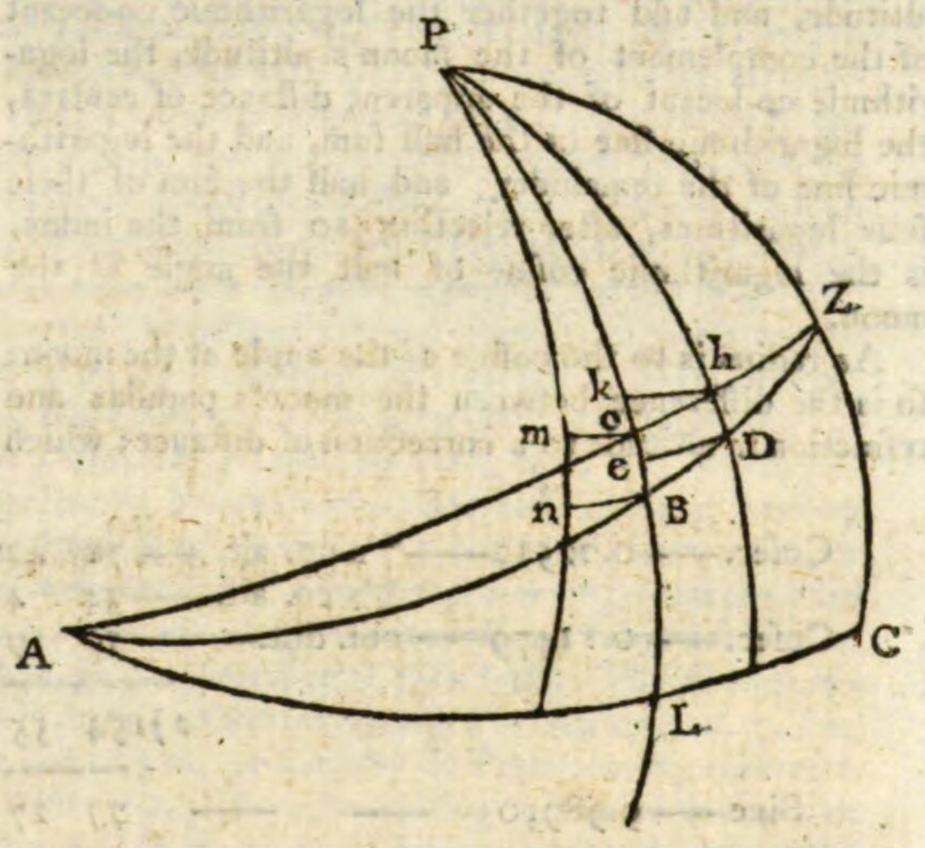
Example. A ſhip from a port, in latitude 56° N. ſails SW. by W. till ſhe arrives at the latitude of 40° N: Required the difference of longitude.

Here $a=34°$, $b=50°$, $c=56°\ 15''$, A=9.48534, B=9.56107, S′=9.9199308, S=9.9198464; therefore, $L=\frac{A\backsim B}{S'-S}=\frac{757300}{844}=897$ the minutes difference of longitude. Alſo, S=9.74474, D=2.98227; therefore E=R+D—S=3.23753, to which the natural number is 1728, the miles in the rhumb-line ſailed over.

2. The common method of finding the difference of longitude made good upon ſeveral courſes and diſtances, by means of the difference of latitude and departure made good upon the ſeveral courſes, is not accurately true.

For example: If a ſhip ſhould ſail due ſouth 600 miles, from a port in 60° north latitude, and then due weſt 600 miles, the difference of longitude found by the common methods of ſolution would be 1053; whereas the true difference of longitude is only 933, leſs than the former by 120 miles, which is more than $\frac{1}{8}$ of the whole. Indeed every conſiderable alteration in the courſe will produce a very ſenſible error in the difference of longitude. Though, when the ſeveral rhumb lines ſailed over are nearly in the ſame direction, the error in longitude will be but ſmall.

The reaſon of this will eaſily appear from the annexed figure, in which the ſhip is ſuppoſed to ſail from Z to A, along the rhumb lines ZB, BA; for if the meridians PZ, PkoeBL be drawn; and very near the latter other two meridians PhD, Pmn; and likewiſe the parallels of latitude Bn, De, mo, hk; then it is plain that De is greater than hk (for De is to hk as the ſine of DP to the ſine of hP): and ſince this is the caſe every where, the departure correſponding to the diſtance BZ and courſe BZC, will be greater than the departure to the diſtance oZ and courſe oZC. And in the ſame manner, we prove that nB is greater than mo; and conſequently, the departure correſponding to the diſtance AB, and courſe ABL, is greater than the departure to the diſtance Ao, and courſe AoL: Wherefore, the ſum of the two departures correſponding to the courſes ABL and BZC, and to the diſtances AB and BZ, is greater than the departure correſponding to the diſtance AZ and courſe AZC: therefore the courſe anſwering to this ſum as a departure, and CZ as a difference of latitude, (AC being the parallel of latitudes paſſing through A), will be greater than the true courſe AZC made good upon the whole. And hence the difference of longitude found by the common rules will be greater than the true difference of longitudes; and the error will be greater or leſs according as BA deviates more or leſs from the direction of BZ.



3. Of determining the ſhip's longitude by lunar obſervations.

Several rules for this purpoſe have been lately publiſhed, the principal object of which ſeems to have been to abbreviate the computations requiſite for determining the true diſtance of the ſun or a ſtar from the moon's centre. This, however, ſhould have certainly been leſs attended to than the inveſtigation of a ſolution, in which conſiderable errors in the data may produce a ſmall error in the required diſtance. When either of the luminaries has a ſmall elevation, its altitude will be affected by the variableneſs of the atmoſphere; likewiſe the altitude, as given by the quadrant, will be affected by the inaccuracy of the inſtrument, and the uncertainty neceſſarily attending all obſervations made

(A) A ∽B ſignifies the difference between A and B.

Longitude. made at ſea. The ſum of theſe errors, when they all tend the ſame way, may be ſuppoſed to amount to at leaſt one minute in altitude; which, in many caſes, according to the common rules for computing the true diſtance, will produce an error of about 30 minutes in the longitude. Thus, in the example given by Monſ. Callet, in the *Tables Portatives*, if we ſuppoſe an error of one minute in the ſun's altitude, or call it 6° 26′ 34″, inſtead of 6° 27′ 34″; we ſhall find the alteration in diſtance according to his rule to be 54′, producing an error of about 27 minutes in the longitude: for the angle at the ſun will be found, in the ſpherical triangle whoſe ſides are the complement of the ſun's altitude, complement of the moon's altitude, and obſerved diſtance, to be about 26°; and as radius is to the coſine of 26°, ſo is 60″ the ſuppoſed error in altitude, to 54″ the alteration in diſtance. Perhaps the only method of determining the diſtance, ſo as not to be affected by the errors of altitude, is that by firſt finding the angles at the ſun and moon, and by the help of them the corrections of diſtance for parallax and refraction. The rule is as follows:

Add together the complement of the moon's apparent altitude, the complement of the ſun's apparent altitude, and the apparent diſtance of centres; from half the ſum of theſe ſubtract the complement of the ſun's altitude, and add together the logarithmic co-ſecant of the complement of the moon's altitude, the logarithmic co-ſecant of the apparent diſtance of centres, the logarithmic ſine of the half ſum, and the logarithmic ſine of the remainder; and half the ſum of theſe four logarithms, after rejecting 20 from the index, is the logarithmic coſine of half the angle at the moon.

As radius is to the coſine of the angle at the moon; ſo is the difference between the moon's parallax and refraction in altitude to a correction of diſtance; which is to be added to the apparent diſtance of centres when the angle at the moon is obtuſe; but to be ſubtracted when that angle is acute, in order to have the diſtance once corrected. Longitude.

In the above formula, if the word *ſun* be changed for *moon*, and *vice verſa*, wherever theſe terms occur, we ſhall find a ſecond correction of diſtance to be applied to the diſtance, once corrected by ſubtraction when the angle at the ſun is obtuſe, but by addition when that angle is acute, and the remainder or ſum is the true diſtance nearly.

In applying this rule, it will be ſufficient to uſe the complement, altitudes, and apparent diſtances of centres, true to the neareſt minute only, as a ſmall error in the angles at the ſun and moon will very little affect the corrections of diſtances.

If D be the computed diſtance in ſeconds, d the difference between the moon's parallax and refraction in altitude, S the ſine of the angle at the moon, and R the radius; then $\frac{d^2 S^2}{2DR}$ will be a third correction of diſtance, to be added to the diſtance twice corrected: But it is plain, from the nature of this correction, that it may be always rejected, except when the diſtance D is very ſmall, and the angle at the moon nearly equal to 90°.

This ſolution is likewiſe of uſe in finding the true diſtance of a ſtar from the moon, by changing the word *ſun* into *ſtar*, and uſing the refraction of the ſtar, inſtead of the difference between the refraction and parallax in altitude of the ſun, in finding the ſecond correction of diſtance.

Ex. Given the obſerved diſtance of a ſtar from the centre of the moon, 50° 8′ 41″; the moon's altitude, 55° 58′ 5″; the ſtar's altitude, 19° 18′ 5″; and the moon's horizontal parallax, 1° 0′ 5″: Required the true diſtance.

Coſec.——0.02512——*'s co. alt. ——70° 42′
☽'s co. alt.——34 4——Coſec. ——0.25169
Coſec.—— 0.11479——obſ. diſt.———50 9———Coſec. ——0.11479
2)154 55
Sine——9.98950 —— —— 77 27———— Sine——9.98950
Rem. 6 45———— Sine——9.07018
Sine——9.83688 —— Rem. 43 23 2)19.42616
2)19.96629 ————Coſec.——9.71308——58° 54′
Coſec. ——9.98314—— 15° 54′———— 2
2
117 48 = ☽'s angle.
31 48 = *'s angle.

Rad. : Coſec. 117° 48′ : : ☽' diff. parall. & refract. 1980″ : 923″ = 1ſt correct. of diſtance.
Rad. · Coſec. 31° 48′ : ſtar's refract. 162″ : 138″ = 2d correct. of diſtance.

Here the firſt correction of diſtance is additive, ſince the angle at the moon is obtuſe; and the ſecond correction is alſo additive, ſince the angle at the ſtar is acute: therefore their ſum 923″ + 138″ = 1061″ = 17′ 41″, being added to 50° 8′ 41″, the apparant diſtance of the ſtar from the moon's centre, gives 50° 26′ 21″ for the true diſtance of centres nearly;—and 2×L (d+S)—L (2 L R+L 2+L D) = L 8″, which, being added to the diſtance twice corrected, gives 50° 26′ 29″ for the true diſtance. By comparing

Longitudinal || Longus.

ring this distance with the computed distances in the ephemeris, the time at Greenwich corresponding to that of observing the distance will be known; and the difference of those times being converted into degrees and minutes, at the rate of 15 degrees to the hour, will give the longitude of the place of observation; which will be east if the time at the place be greater than that at Greenwich, but west if it be less.

LONGITUDINAL, in general, denotes something placed lengthwise: thus some of the fibres in the vessels of the human body are placed longitudinally, others transversely or across.

LONGOBARDI. See LANGOBARDI.

LONGOMONTANUS (Christian), a learned astronomer, born in a village of Denmark in 1562. He was the son of a ploughman; and was obliged to suffer during his studies all the hardships to which he could be exposed, dividing his time, like the philosopher Cleanthes, between the cultivation of the earth and the lessons he received from the minister of the place. At last, when he was 15, he stole away from his family, and went to Wiburg, where there was a college, in which he spent 11 years; and though he was obliged to earn a livelihood, he applied himself to study with such ardour, that among other sciences he learned the mathematics in great perfection. He afterwards went to Copenhagen; where the professors of that university in a short time conceived so high an opinion of him, that they recommended him to the celebrated Tycho Brahe. Longomontanus lived eight years with that famous astronomer, and was of great service to him in his observations and calculations. At length, being extremely desirous of obtaining a professor's chair in Denmark, Tycho Brahe consented, though with some difficulty, to deprive himself of his service; gave him a discharge, filled with the highest testimonies of his esteem; and furnished him with money for the expence of his long journey. He obtained a professorship of mathematics in the university of Copenhagen in 1605; and discharged the duty of it worthily till his death, which happened in 1647. He wrote many learned works; amused himself with endeavouring to square the circle, and pretended that he had made that discovery; but Dr John Pell, an English mathematician, attacked him warmly on that subject, and proved that he was mistaken.

LONGTOWN, a town of Cumberland, on the Scots borders, near the conflux of the Esk and Kirksop, seven miles from Carlisle, and 313 miles from London; it has a market on Thursday, and a charity-school for 60 children, with two fairs in the year.

LONGUEVILLE, a town of France, in Upper Normandy, and in the territory of Caux, seated on the small river Lee, 17 miles north of Rouen. It has the title of a duchy. E. Long. 1. 10. N. Lat. 49. 46.

LONGWY, a town of France, on the frontiers of the duchy of Luxemburg, with a castle, divided into the old and new towns. This last was built and fortified by Louis XIV. It is seated on an eminence. E. Long. 5. 51. N. Lat. 40. 32.

LONGUS, a Greek sophist, author of a book intitled Ποιμενικα, or Pastorals, and a romance containing the loves of Daphnis and Chloe. Huetius, bishop of Avranches, speaks very advantageously of this work; but he censures the obscene touches with which it is interspersed. None of the ancient authors mention him, so the time when he lived cannot be certainly fixed. There is an English translation of this author, which is ascribed to the late J. Craggs, Esq; secretary of state.

Lonicera.

LONICERA, HONEYSUCKLE, in botany: A genus of the monogynia order, belonging to the pentandria class of plants. The corolla is monopetalous and irregular; the berry polyspermous, bilocular, and inferior.

Species. 1. The alpigena, or upright red-berried honeysuckle, rises with a shrubby, short, thick, upright stem, branching strong and erectly four or five feet high; largish, spear-shaped leaves, in pairs opposite; and from the sides of the branches many red flowers by two's on long footstalks, each succeeded by two red berries joined together at their base; it flowers in August, and the berries ripen in autumn. 2. The cærulea, or blue-berried upright honeysuckle, rises with a shrubby upright stem, branching moderately three or four feet high, with many white flowers proceeding from the sides of the branches; appearing in May, and succeeded by blue berries joined together at their base. 3. The nigra, or black-berried upright honeysuckle, rises with a shrubby stem branching three or four feet high, with white flowers succeeded by single and distinct black-berries. 4. The tartarica, or Tartarian honeysuckle, rises with a shrubby upright stem, branching erectly three or four feet high; heart shaped, opposite leaves, and whitish erect flowers succeeded by red berries, sometimes distinct, and sometimes double. 5. The diervilla, or yellow-flowered Arcadian honeysuckle, rises with shrubby upright stalks, branching erect to the height of three or four feet; the branches terminated by clusters of pale yellow flowers, appearing in May and June, and sometimes continuing till autumn; but rarely ripening seeds here. 6. The xylosteum, or fly honeysuckle, rises with a strong shrubby stem, branching erect to the height of seven or eight feet; with erect white flowers proceeding from the sides of the branches; each succeeded by large double red berries, joined together at their base. The flowers appear in June, and the berries ripen in September. 7. The symphoricarpos, or shrubby St Peter's-wort, rises with a shrubby, rough stem, branching erect four or five feet high, with small greenish flowers appearing round the stalk in August. 8. The periclymenum, or common climbing honeysuckle, hath two principal varieties, viz. The English wild honeysuckle, or woodbine of our woods and hedges, and the Dutch or German honeysuckle. The former rises with shrubby, weak, very long slender stalks, and branches trailing on the ground, or climbing round any support; all terminated by oval imbricated heads, furnishing smallish flowers of white or red colours, and appearing from June or July till autumn. The Dutch honeysuckle rises with a shrubby declinated stalk, and long trailing purplish branches, terminated by oval imbricated heads, furnishing large beautiful red flowers of a fragrant odour, appearing in June and July. 9. The caprifolium, or Italian honeysuckle, rises with shrubby declinated stalks, sending out long slender trailing branches, terminated by verticillate or whorled bunches of close-sitting flowers, very fragrant, and white, red, and yellow colours. 10. The sempervirens, or evergreen trumpet-flowered honeysuckle,

Lonſdale || Loom.

ſuckle, riſes with a ſhrubby declinated ſtalk, ſending out long ſlender trailing branches, terminated by naked verticillate ſpikes, of long, unreflexed, deep ſcarlet flowers, very beautiful, but of little fragrance.

Culture. The moſt eaſy method of propagating theſe plants is by layers or cuttings, eſpecially the latter; both of theſe readily emit roots, and form plants in one year fit for tranſplantation. Some ſorts are alſo propagated by ſuckers and ſeed.

LONSDALE, or *Kirkby* LONSDALE, a town of Weſtmoreland, ſeated on the river Lon, in a pleaſant and rich valley of the ſame name. It is a large well-built town, has a handſome church, and a fine ſtone-bridge over the river. It is well inhabited; and is the beſt town in the county except Kendal. It gives title of Earl to the Lowther family. W. Long. 2. 27. N. Lat. 54. 10.

LOO, a town of the United Provinces, in Guelderland, eight miles weſt of Deventer, where the prince of Orange has a fine palace. E. Long. 6. 0. N. Lat. 52. 18.

LOOF, the after part of a ſhip's bow; or that part of her ſide forward where the planks begin to be incurvated into an arch as they approach the ſtem.

LOOF, or *Luff.* See LUFF.

LOOK-OUT, in the ſea-language, a watchful attention to ſome important object or event which is expected to ariſe from the preſent ſituation of a ſhip, &c. It is principally uſed in navigation when there is a probability of danger from the real or ſuppoſed proximity of land, rocks, enemies, and, in ſhort, whatever peril ſhe may encounter through inattention, which might otherwiſe have been avoided by a prudent and neceſſary vigilance.

There is always a look-out kept on a ſhip's forecaſtle at ſea, to watch for any dangerous objects lying near her track, and to which ſhe makes a gradual approach as ſhe advances: the mate of the watch accordingly calls often from the quarter-deck, "Look out afore there!" to the perſons appointed for this ſervice.

LOOKING-GLASSES, are nothing but plain mirrors of glaſs; which, being impervious to the light, reflect the images of things placed before them. See the articles MIRROR and OPTICS.

For the caſting, grinding, and poliſhing of looking-glaſſes, ſee the article GLASS.

For foliating of looking-glaſſes. See the article FOLIATING.

LOOL, in metallurgy, a veſſel made to receive the waſhings of ores of metals. The heavier or more metalline part of the ores remain in the trough in which they are waſhed; the lighter and more earthy run off with the water, but ſettle in the lool.

LOOM, the weaver's frame; a machine whereby ſeveral diſtinct threads are woven into one piece.

Looms are of various ſtructures, accommodated to the various kinds of materials to be woven, and the various manner of weaving them; *viz.* for woollens, ſilks, linens, cottons, cloths of gold: and other works, as tapeſtry, ribbands, ſtockings, &c. divers of which will be found under their proper heads. See WEAVING.

The weaver's loom-engine, otherwiſe called the Dutch loom-engine, was brought into uſe from Holland to London, in or about the year 1676.

Heir-Loom, in law. See *HEIR-Loom*.

LOOM, at ſea. If a ſhip appears big, when at a diſtance, they ſay ſhe looms, or appears a great ſail: the term is alſo uſed to denote the indiſtinct appearance of any other diſtant objects. Loom || Lophius.

Loom-gale, at ſea, a gentle eaſy gale of wind, in which a ſhip can carry her top-ſails a-trip.

LOOP, in the iron works, is a part of a ſow or block of caſt iron broken or melted off from the reſt, and prepared for the forge or hammer. The uſual method is, to break off the loop of about three quarters of a hundred weight. This loop they take up with their ſlinging-tongs, and beat it with iron ſledges upon an iron plate near the fire, that ſo it may not fall to pieces, but be in a condition to be carried under the hammer. It is then placed under the hammer, and a little water being drawn to make the hammer move but ſoftly, it is beat very gently, and by this means the droſs and foulneſs are forced off, and after this they draw more and more water by degrees, and beat it more and more till they bring it to a four-ſquare maſs, of about two feet long, which they call a bloom.

LOOPING, in metallurgy, a word uſed by the miners of ſome counties of England, to expreſs the running together of the matter of an ore into a maſs, in the roaſting or firſt burning, intended only to calcine it ſo far as to make it fit for powdering. This accident, which gives the miners ſome trouble, is generally owing to the continuing the fire too long in this proceſs.

LOOSE-STRIFE. See LYSIMACHIA.

LOOSA, in botany: A genus of the monogynia order, belonging to the polyandria claſs of plants. The calyx is pentaphyllous, ſuperior; there are five ſubovate, cucullated, and large petals; the nectarium conſiſts of five leaves, gathered into a conical figure, each terminated by two filaments; the capſule is turbinated, unilocular, and trivalved at top; the ſeeds are very numerous; and there are three linear and longitudinal ſinuſes.

LOPES LE VEGA. See VEGA.

LOPEZ, or INDIAN, Root, in the materia medica. The plant to which this article belongs is unknown. Neither the woody nor cortical part of the root has any remarkable ſenſible quality. A ſlight bitterneſs is perceptible; and it is recommended, like ſimarouba, in diarrhœas even of the colliquative kind, in half-dram doſes four times a-day. Little of this root has been brought to Europe: but ſome of thoſe who have had an opportunity of employing it, ſpeak in very high terms of the effects obtained from it.

LOPHIUS, FISHING-FROG, *Toad-fiſh*, or *Sea-devil*; a genus of the branchioſtegious order of fiſhes, whoſe head is in ſize equal to all the reſt of the body. There are three ſpecies; the moſt remarkable of which is the piſcatorius, or common fiſhing-frog, an inhabitant of the Britiſh ſeas. This ſingular fiſh was known to the ancients by the name of βατραχος, and *rana*; and to us by that of the *fiſhing-frog*, for it is of a figure reſembling that animal in a tadpole ſtate. Pliny takes notice of the artifice uſed by it to take its prey: *Eminentia ſub oculis cornicula turbato limo exerit, aſſultantes piſciculos attrahens, donec tam prope accedunt, ut aſſiliat.* "It puts forth the ſlender horns it has beneath its eyes, enticing by that means the little fiſh to play round, till they come within reach, when it ſprings on

Lo[hius ‖ Lord.

on them." The fiſhing-frog grows to a large ſize, ſome being between four and five feet in length; and Mr Pennant mentions one taken near Scarborough, whoſe mouth was a yard wide. The fiſhermen on that coaſt have a great regard for this fiſh, from a ſuppoſition that it is a great enemy to the dog-fiſh; and whenever they take it with their lines, ſet it at liberty.

It is a fiſh of very great deformity: the head is much bigger than the whole body; is round at the circumference, and flat above; the mouth of a prodigious wideneſs. The under jaw is much longer than the upper: the jaws are full of ſlender ſharp teeth: in the roof of the mouth are two or three rows of the ſame: at the root of the tongue, oppoſite each other, are two bones of an elliptical form, thick ſet, with very ſtrong ſharp teeth. The noſtrils do not appear externally, but in the upper part of the mouth are two large orifices that ſerve inſtead of them. On each ſide the upper-jaw are two ſharp ſpines, and others are ſcattered about the upper part of the head. Immediately above the noſe are two long tough filaments, and on the back three others; theſe are what Pliny calls *cornicula*, and ſays it makes uſe of to attract the little fiſh. They ſeem to be like lines flung out for that end. Along the edges of the head and body are a multitude of ſhort fringed ſkins, placed at equal diſtances. The aperture to the gills is placed behind; each of theſe is very wide, ſo that ſome writers have imagined it to be a receptacle for the young in time of danger. The body grows ſlender near the tail, the end of which is quite even. The colour of the upper part of this fiſh is duſky, the lower part white; the ſkin ſmooth.

LORANTHUS, in botany: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The germen is inferior; there is no calyx; the corolla is ſexfid and revoluted; the ſtamina are at the tops of the petals; the berry is monoſpermous. There is only one ſpecies, a native of America, diſcovered by Father Plumier, and found growing naturally at La Vera Cruz by Dr Houſton. It riſes with a ſhrubby ſtalk, eight or ten feet high, dividing into ſeveral branches, having at their ends cluſters of ſmall ſcarlet-coloured flowers, ſucceeded by oval berries with a pulpy covering, and a hard ſhell with one cell, incloſing ſeveral compreſſed ſeeds. It is propagated by ſeeds, which ſhould be ſown ſoon after they are ripe; otherwiſe they are very apt to miſcarry, or lie a year in the ground without germinating. The plants require always to be kept in a bark-ſtove.

LORARII, among the Romans, officers whoſe buſineſs it was, with whips and ſcourges, to compel the gladiators to engage. The *lorarii* alſo puniſhed ſlaves who diſobeyed their maſters.

LORD, a title of honour given to thoſe who are noble either by birth or creation. In this ſenſe, it amounts to much the ſame as *peer of the realm*, or *lord of parliament*. The title is by courteſy alſo given to all the ſons of dukes and marquiſes, and to the eldeſt ſons of earls: and it is alſo a title of honour beſtowed on thoſe who are honourable by their employments; as *lord advocate*, *lord chamberlain*, *lord chancellor*, &c. The word is Saxon, but abbreviated from two ſyllables into one; for it was originally *Illaford*, which by dropping the aſpiration became *Laford*, and afterwards by contraction *Lord*. "The etymology of the word (ſays J. Coates) is well worth obſerving; for it was compoſed of *illaf* "a loaf of bread," and *ford* "to give or afford;" ſo that *Illaford*, now *Lord*, implies "a giver of bread;" becauſe, in thoſe ages, ſuch great men kept extraordinary houſes, and fed all the poor; for which reaſon they were called *givers of bread*, a thing now much out of date, great men being fond of retaining the title, but few regarding the practice for which it was firſt given. See LADY.

Lord.

Houſe of LORDS, one of the three eſtates of parliament, and compoſed of the Lords Spiritual and Temporal.

1. The *Spiritual Lords* conſiſt of 2 archbiſhops and 24 biſhops; and, at the diſſolution of monaſteries by Henry VIII. conſiſted likewiſe of 26 mitred abbots and two priors: a very conſiderable body, and in thoſe times equal in number to the temporal nobility. All theſe hold, or are ſuppoſed to hold, certain ancient baronies under the king: for William the Conqueror thought proper to change the ſpiritual tenure of frank-almoign or free-alms, under which the biſhops held their lands during the Saxon government, into the feodal or Norman tenure by barony; which ſubjected their eſtates to all civil charges and aſſeſſments, from which they were before exempt; and in right of ſucceſſion to thoſe baronies, which were unalienable from their reſpective dignities, the biſhops and abbots were allowed their ſeats in the houſe of lords. But though theſe lords ſpiritual are in the eye of the law a diſtinct eſtate from the lords temporal, and are ſo diſtinguiſhed in moſt of our acts of parliament; yet in practice they are uſually blended together under the name of *the lords*; they intermix in their votes, and the majority of ſuch intermixture joins both eſtates. And from this want of a ſeparate aſſembly, and ſeparate negative of the prelates, ſome writers have argued very cogently, that the lords ſpiritual and temporal are now in reality only one eſtate: which is unqueſtionably true in every effectual ſenſe, though the ancient diſtinction between them ſtill nominally continues. For if a bill ſhould paſs their houſe, there is no doubt of its validity, tho' every lord ſpiritual ſhould vote againſt it; of which Selden and Sir Edward Coke give many inſtances: as, on the other hand, doubtleſs it would be equally good, if the lords temporal preſent were inferior to the biſhops in number, and every one of thoſe temporal lords gave his vote to reject the bill; though this Sir Edward Coke ſeems to doubt of.

2. The *Temporal Lords* conſiſt of all the peers of the realm, (the biſhops not being in ſtrictneſs held to be ſuch, but merely lords of parliament), by whatever title of nobility diſtinguiſhed; dukes, marquiſes, earls, viſcounts, or barons †. Some of theſe ſit by deſcent, as do all ancient peers; ſome by creation, as do all new-made ones; others, ſince the union with Scotland, by election, which is the caſe of the 16 peers, who repreſent the body of the Scots nobility. Their number is indefinite, and may be increaſed at will by the power of the crown: and once, in the reign of Queen Anne, there was an inſtance of creating no leſs than 12 together; in contemplation of which, in the reign of King George I. a bill paſſed the houſe of lords, and

† See *Nobility*.

Lord. was countenanced by the then miniſtry, for limiting the number of the peerage. This was thought by ſome to promiſe a great acquiſition to the conſtitution, by reſtraining the prerogative from gaining the aſcendant in that auguſt aſſembly, by pouring in at pleaſure an unlimited number of new-created lords. But the bill was ill reliſhed, and miſcarried in the houſe of commons, whoſe leading members were then deſirous to keep the avenues to the other houſe as open and eaſy as poſſible.

The diſtinction of ranks and honours is neceſſary in every well-governed ſtate: in order to reward ſuch as are eminent for their ſervices to the public, in a manner the moſt deſirable to individuals, and yet without burthen to the community; exciting thereby an ambitious yet laudable ardour and generous emulation in others. And emulation, or virtuous ambition, is a ſpring of action which, however dangerous or invidious in a mere republic or under a deſpotic ſway, will certainly be attended with good effects under a free monarchy; where, without deſtroying its exiſtence, its exceſſes may be continually reſtrained by that ſuperior power from which all honour is derived. Such a ſpirit, when nationally diffuſed, gives life and vigour to the community; it ſets all the wheels of government in motion, which, under a wiſe regulator, may be directed to any beneficial purpoſe; and thereby every individual may be made ſubſervient to the public good, while he principally means to promote his own particular views. A body of nobility is alſo more particularly neceſſary in our mixed and compounded conſtitution, in order to ſupport the rights of both the crown and the people, by forming a barrier to withſtand the encroachments of both. It creates and preſerves that gradual ſcale of dignity which proceeds from the peaſant to the prince; riſing like a pyramid from a broad foundation, and diminiſhing to a point as it riſes. It is this aſcending and contracting proportion that adds ſtability to any government; for when the departure is ſudden from one extreme to another, we may pronounce that ſtate to be precarious. The nobility therefore are the pillars, which are reared from among the people, more immediately to ſupport the throne; and, if that falls, they muſt alſo be buried under its ruins. Accordingly, when in the laſt century the commons had determined to extirpate monarchy, they alſo voted the houſe of lords to be uſeleſs and dangerous. And ſince titles of nobility are thus expedient in the ſtate, it is alſo expedient that their owners ſhould form an independent and ſeparate branch of the legiſlature. If they were confounded with the maſs of the people, and like them had only a vote in electing repreſentatives, their privileges would ſoon be borne down and overwhelmed by the popular torrent, which would effectually level all diſtinctions. It is therefore highly neceſſary that the body of nobles ſhould have a diſtinct aſſembly, diſtinct deliberations, and diſtinct powers from the commons. See alſo KING, NOBILITY, PARLIAMENT, COMMONS, *and* COMMONALTY.

As to the peculiar laws and cuſtoms relating to the houſe of lords: One very ancient privilege is that declared by the charter of the foreſt, confirmed in parliament 9 Hen. III.; viz. that every lord ſpiritual or temporal ſummoned to parliament, and paſſing through the king's foreſts, may, both in going and returning, kill one or two of the king's deer without warrant; in view of the foreſter if he be preſent, or on blowing a horn if he be abſent; that he may not ſeem to take the king's veniſon by ſtealth. Lord ‖ Loretto.

In the next place, they have a right to be attended, and conſtantly are, by the judges of the court of king's-bench and common-pleas, and ſuch of the barons of the exchequer as are of the degree of the coif, or have been made ſerjeants at law; as likewiſe by the king's learned counſel, being ſerjeants, and by the maſters of the court of chancery; for their advice in point of law, and for the greater dignity of their proceedings. The ſecretaries of ſtate, with the attorney and ſolicitor general, were alſo uſed to attend the houſe of peers, and have to this day (together with the judges, &c.) their regular writs of ſummons iſſued out at the beginning of every parliament, *ad tractandum et conſilium impendendum*, though not *ad conſentiendum*: but, whenever of late years they have been members of the houſe of commons, their attendance here hath fallen into diſuſe.

Another privilege is, that every peer, by licence obtained from the king, may make another lord of parliament his proxy, to vote for him in his abſence: A privilege, which a member of the other houſe can by no means have, as he is himſelf but a proxy for a multitude of other people.

Each peer has alſo a right, by leave of the houſe, when a vote paſſes contrary to his ſentiments, to enter his diſſent on the journals of the houſe, with the reaſons for ſuch diſſent; which is uſually ſtyled his proteſt.

All bills likewiſe, that may in their conſequences any way affect the rights of the peerage, are by the cuſtom of parliament to have their firſt riſe and beginning in the houſe of peers, and to ſuffer no changes or amendments in the houſe of commons.

There is alſo one ſtatute peculiarly relative to the houſe of lords; 6 Ann. c. 23. which regulates the election of the 16 repreſentative peers of North Britain, in conſequence of the 22d and 23d articles of the union: and for that purpoſe preſcribes the oaths, &c. to be taken by the electors; directs the mode of balloting; prohibits the peers electing from being attended in an unuſual manner; and expreſsly provides, that no other matter ſhall be treated of in that aſſembly, ſave only the election, on pain of incurring a præmunire. See alſo the articles NOBILITY and PEERS.

LORDOSIS, (of λορδος, *bent inwards*), in the medical writings, a name given to a diſtempered ſtate of the ſpine, in which it is bent inwards, or toward the anterior parts. It is uſed in oppoſition to *gibbous*, or *hump-backed*. See SURGERY.

LORETTO, a town of Italy, in the Marca or Marche of Ancona, with a biſhop's ſee. It is ſmall, but fortified; and contains the famous *caſa ſanta*, or holy chapel, ſo much viſited by pilgrims. This chapel, according to the legend, was originally a ſmall houſe in Nazareth, inhabited by the virgin Mary, in which ſhe was ſaluted by the angel, and where ſhe bred our Saviour. After their deaths, it was held in great veneration by all believers in Jeſus, and at length conſecrated into a chapel, and dedicated to the virgin; upon which occaſion St Luke made that identical image,

Loretto. image, which is ſtill preſerved here, and dignified with the name of our Lady of Loretto. This ſanctified edifice was allowed to ſojourn in Galilee as long as that diſtrict was inhabited by Chriſtians; but when infidels got poſſeſſion of the country, a band of angels, to ſave it from pollution, took it in their arms, and conveyed it from Nazareth to a caſtle in Dalmatia. This fact might have been called in queſtion by incredulous people, had it been performed in a ſecret manner; but, that it might be manifeſt to the moſt ſhort-ſighted ſpectator, and evident to all who were not perfectly deaf as well as blind, a blaze of celeſtial light, and a concert of divine muſic, accompanied it during the whole journey; beſides, when the angels, to reſt themſelves, ſet it down in a little wood near the road, all the trees of the foreſt bowed their heads to the ground, and continued in that reſpectful poſture as long as the ſacred chapel remained among them. But, not having been entertained with ſuitable reſpect at the caſtle above mentioned, the ſame indefatigable angels carried it over the ſea, and placed it in a field belonging to a noble lady called *Lauretta*, from whom the chapel takes its name. This field happened unfortunately to be frequented at that time by highwaymen and murderers: a circumſtance with which the angels undoubtedly were not acquainted when they placed it there. After they were better informed, they removed it to the top of a hill belonging to two brothers, where they imagined it would be perfectly ſecure from the dangers of robbery or aſſaſſination; but the two brothers, the proprietors of the ground, being equally enamoured of their new viſitor, became jealous of each other, quarrelled, fought, and fell by mutual wounds. After this fatal cataſtrophe, the angels in waiting finally moved the holy chapel to the eminence where it now ſtands, and has ſtood theſe 400 years, having loſt all reliſh for travelling.

The ſacred chapel ſtands due eaſt and weſt, at the farther end of a large church of the moſt durable ſtone of Iſtria, which has been built around it. This may be conſidered as the external covering, or as a kind of great coat to the *caſa ſanta*, which has a ſmaller coat of more precious materials and workmanſhip nearer its body. This internal covering or caſe is of the choiceſt marble, after a plan of San Savino's, and ornamented with baſſo relievos, the workmanſhip of the beſt ſculptors which Italy could furniſh in the reign of Leo X. The ſubject of thoſe baſſo relievos are, the hiſtory of the bleſſed virgin, and other parts of the Bible. The whole caſe is about 50 feet long, 30 in breadth, and the ſame in height; but the real houſe itſelf is no more than 32 feet in length, 14 in breadth, and at the ſides about 18 feet in height; the centre of the roof is four or five feet higher. The walls of this little holy chapel are compoſed of pieces of a reddiſh ſubſtance, of an oblong ſquare ſhape, laid one upon another, in the manner of brick. At firſt ſight, on a ſuperficial view, theſe red-coloured oblong ſubſtances appear to be nothing elſe than common Italian bricks; and, which is ſtill more extraordinary, on a ſecond and third view, with all poſſible attention, they ſtill have the ſame appearance. Travellers, however, are aſſured, with great earneſtneſs, that there is not a ſingle particle of brick in their whole compoſition, being entirely of a ſtone, which, though it cannot now be found in Paleſtine, was formerly very common, particularly in the neighbourhood of Nazareth. Loretto.

The holy houſe is divided within into two unequal portions, by a kind of grate-work of ſilver. The diviſion towards the weſt is about three-fourths of the whole; that to the eaſt is called the *Sanctuary*. In the larger diviſion, which may be conſidered as the main body of the houſe, the walls are left bare, to ſhow the true original fabric of Nazareth ſtone; for they muſt not be ſuppoſed to be bricks. At the lower or weſtern wall there is a window, the ſame through which the angel Gabriel entered at the Annunciation. The architraves of this window are covered with ſilver. There are a great number of golden and ſilver lamps in this chapel: one of the former, a preſent from the republic of Venice, is ſaid to weigh 37 pounds, and ſome of the ſilver lamps weigh from 120 to 130 pounds. At the upper end of the largeſt room is an altar, but ſo low, that from it you may ſee the famous image which ſtands over the chimney in the ſmall room or ſanctuary. Golden and ſilver angels, of conſiderable ſize, kneel around her, ſome offering hearts of gold, enriched with diamonds, and one an infant of pure gold. The wall of the ſanctuary is plated with ſilver, and adorned with crucifixes, precious ſtones, and votive gifts of various kinds. The figure of the Virgin herſelf by no means correſponds with the fine furniture of her houſe: She is a little woman, about four feet in height, with the features and complexion of a negro. Of all the ſculptors that ever exiſted, aſſuredly St Luke, by whom this figure is ſaid to have been made, is the leaſt of a flatterer; and nothing can be a ſtronger proof of the bleſſed Virgin's contempt for external beauty, than her being ſatisfied with this repreſentation of her. The figure of the infant Jeſus, by St Luke, is of a piece with that of the Virgin: he holds a large golden globe in one hand, and the other is extended in the act of bleſſing. Both figures have crowns on their heads, enriched with diamonds: theſe were preſents from Ann of Auſtria queen of France. Both arms of the Virgin are incloſed within her robes, and no part but her face is to be ſeen; her dreſs is moſt magnificent, but in a wretched bad taſte: this is not ſurpriſing, for ſhe has no female attendant. She has particular clothes for the different feaſts held in honour of her, and, which is not quite ſo decent, is always dreſſed and undreſſed by the prieſts belonging to the chapel; her robes are ornamented with all kinds of precious ſtones down to the hem of her garment.

There is a ſmall place behind the ſanctuary, in which are ſhown the chimney, and ſome other furniture, which they pretend belonged to the Virgin when ſhe lived at Nazareth; particularly a little earthen porringer, out of which the infant uſed to eat. The pilgrims bring roſaries, little crucifixes, and Agnus Dei's, which the obliging prieſt ſhakes for half a minute in this diſh; after which it is believed they acquire the virtue of curing various diſeaſes, and prove an excellent preventative of all temptations of Satan. The gown which the image had on when the chapel arrived from Nazareth is of red camblet, and carefully kept in a glaſs ſhrine.

Above 100 maſſes are daily ſaid in this chapel, and in the church in which it ſtands. The jewels and

riches

Loretto

riches to be ſeen at any one time in the holy chapel are of ſmall value in compariſon of thoſe in the treaſury, which is a large room adjoining to the veſtry of the great church. In the preſſes of this room are kept thoſe preſents which royal, noble, and rich bigots of all ranks, have, by oppreſſing their ſubjects and injuring their families, ſent to this place. To enumerate every particular would fill volumes. They conſiſt of various utenſils and other things in ſilver and gold; as lamps, candleſticks, goblets, crowns, and crucifixes; lambs, eagles, ſaints, apoſtles, angels, virgins, and infants: then there are cameos, pearls, gems, and precious ſtones, of all kinds and in great numbers. What is valued above all the other jewels is, the miraculous pearl, wherein they aſſert that Nature has given a faithful delineation of the Virgin ſitting on a cloud with the infant Jeſus in her arms. There was not room in the preſſes of the treaſury to hold all the ſilver pieces which have been preſented to the Virgin. Several other preſſes in the veſtry are completely full. It is ſaid that thoſe pieces are occaſionally melted down by his holineſs for the uſe of the ſtate; and alſo that the moſt precious of the jewels are picked out and ſold for the ſame purpoſe, falſe ſtones being ſubſtituted in their room.

Pilgrimages to Loretto are not ſo frequent with foreigners, or with Italians of fortune and diſtinction, as formerly; nineteen out of twenty of thoſe who make this journey now are poor people, who depend for their maintenance on the charity they receive on the road. To thoſe who are of ſuch a rank in life as precludes them from availing themſelves of the charitable inſtitutions for the maintenance of pilgrims, ſuch journeys are attended with expence and inconveniency; and fathers and huſbands, in moderate or confined circumſtances, are frequently brought to diſagreeable dilemmas, by the raſh vows of going to Loretto which their wives or daughters are apt to make on any ſuppoſed deliverance from danger. To refuſe, is conſidered by the whole neighbourhood as cruel, and even impious; and to grant, is often highly diſtreſſing, particularly to ſuch huſbands as, from affection or any other motive, do not chooſe that their wives ſhould be long out of their ſight. But the poor, who are maintained during their whole journey, and have nothing more than a bare maintenance to expect from their labour at home, to them a journey to Loretto is a party of pleaſure as well as devotion, and by much the moſt agreeable road they can take to heaven. The greateſt concourſe of pilgrims is at the ſeaſons of Eaſter and Whitſuntide. The rich travel in their carriages: A greater number come on horſeback or on mules; or, what is ſtill more common, on aſſes. Great numbers of females come in this manner, with a male friend walking by them as their guide and protector; but the greateſt number of both ſexes are on foot. The pilgrims on foot, as ſoon as they enter the ſuburbs, begin a hymn in honour of the Virgin, which they continue till they reach the church. The poorer ſort are received into an hoſpital, where they have bed and board for three days.

The only trade of Loretto conſiſts of roſaries, crucifixes, little Madonas, Agnus Dei's, and medals, which are manufactured here, and ſold to pilgrims. There are great numbers of ſhops full of theſe commodities, ſome of them of a high price; but infinitely the greater part are adapted to the purſes of the buyers, and ſold for a mere trifle. The evident poverty of thoſe manufacturers and traders, and of the inhabitants of this town in general, is a ſufficient proof that the reputation of our Lady of Loretto is greatly on the decline. Loretto

In the great church which contains the holy chapel are confeſſionals, where the penitents from every country of Europe may be confeſſed in their own language, prieſts being always in waiting for that purpoſe: each of them has a long white rod in his hand, with which he touches the heads of thoſe to whom he thinks it proper to give abſolution. They place themſelves on their knees in groupes around the confeſſional chair; and when the holy father has touched their heads with the expiatory rod, they retire, freed from the burden of their ſins, and with renewed courage to begin a freſh account.

In the ſpacious area before this church there is an elegant marble fountain, ſupplied with water from an adjoining hill by an aqueduct. Few even of the moſt inconſiderable towns of Italy are without the uſeful ornament of a public fountain. The embelliſhments of ſculpture and architecture are employed with great propriety on ſuch works, which are continually in the people's view; the air is refreſhed and the eye delighted by the ſtreams of water they pour forth; a ſight peculiarly agreeable in a warm climate. In this area there is alſo a ſtatue of Sixtus V. in bronze. Over the portal of the church itſelf is a ſtatue of the Virgin; and above the middle gate is a Latin inſcription, importing, that within is the houſe of the mother of God, in which the Word was made fleſh. The gates of the church are likewiſe of bronze, embelliſhed with baſſo relievos of admirable workmanſhip; the ſubjects taken partly from the Old and partly from the New Teſtament, and divided into different compartments. As the gates of this church are ſhut at noon, the pilgrims who arrive after that time can get no nearer the *ſanta caſa* than theſe gates, which are by this means ſometimes expoſed to the firſt violence of that holy ardour which was deſigned for the chapel itſelf. All the ſculpture upon the gates which is within reach of the mouths of thoſe zealots, is in ſome degree effaced by their kiſſes.

There are alſo ſeveral paintings to be ſeen here, ſome of which are highly eſteemed, particularly two in the treaſury. The ſubject of one of theſe is the Virgin's Nativity, by Annibal Carracci; and of the other, a Holy Family, by Raphael. There are ſome others of conſiderable merit which ornament the altars of the great church. Theſe altars, or little chapels, of which this fabric contains a great number, are lined with marble and embelliſhed by ſculpture; but nothing within this church intereſts a traveller of ſenſibility ſo much as the iron grates before thoſe chapels, which were made of the fetters and chains of the Chriſtian ſlaves, who were freed from bondage by the glorious victory of Lepanto.

The place where the governor reſides ſtands near the church, and the eccleſiaſtics who are employed in it lodge in the ſame palace, where they receive the pilgrims of high diſtinction. The environs of this town are very agreeable, and in fine weather the high

mountains

Lorica || Lorne.

mountains of Croatia may be ſeen from hence. It is ſeated on a mountain, in E. Long. 13. 50. N. Lat. 43. 24.

LORICA, was a cuiraſs, brigantine, or coat of mail, in uſe among the Roman ſoldiers. It was generally made of leather, and is ſuppoſed to be derived from *lorum*.—The loricæ were ſet with plates of metal in various forms; ſometimes in hooks or rings like a chain, ſometimes like feathers, and ſometimes like the ſcales of ſerpents or fiſhes, to which plates of gold were often added. There were other lighter cuiraſſes conſiſting only of many folds of linen cloth, or of flax made ſtrong enough to reſiſt weapons. Such ſoldiers as were rated under 1000 drachms, inſtead of the lorica now deſcribed, wore a *pectorale*.—The Roman lorica was made like a ſhirt, and defended the wearer both before and behind, but was ſo contrived that the back part could be occaſionally ſeparated from the front. Some of the loricæ were made of cords of hemp or flax, cloſe ſet together; whence they are called *thoraces*, *lilices*, *trilices*, &c. from the number of the cords fixed one upon another; but theſe were uſed rather in hunting than in the field of battle.

LORICATION, or COATING, in chemiſtry, is the covering a glaſs or earthen veſſel with a coat or cruſt of a matter able to reſiſt the fire, to prevent its breaking in the performing an operation that requires great violence of fire. See CHEMISTRY.

LORIS, in zoology. See LEMUR.

LORIMERS, one of the companies of London, that make bits for bridles, ſpurs, and ſuch like ſmall iron ware. They are mentioned in ſtatute 1 Rich. II. c. 12.—The word ſeems derived from the Latin word *lorum*, "a thong."

LORME (Philibert de), one of the moſt celebrated architects in the 16th century, was born at Lyons. Queen Catherine de Medicis gave him the ſuperintendance of buildings; and he had the direction of thoſe of the Louvre, the Thuilleries, the caſtle of St Anet, St Germains, and other edifices erected by her orders. He wrote ſeveral books of architecture, which are eſteemed; and died about the year 1577.

LORNE, a diviſion of Argyleſhire in Scotland, which gives the title of marquis to the duke of Argyle. It extends above 30 miles in length from north to ſouth, and about nine at its utmoſt breadth; bounded on the eaſt by Braidalbin; on the weſt, by the iſlands; on the north, by Lochaber; and is divided from Knapdale on the ſouth by Loch Etive, on the banks of which ſtands the caſtle of Bergomarn, wherein the courts of juſtice were anciently held. This diſtrict, abounding with lakes, is the moſt pleaſant and fertile part of Argyleſhire, producing plenty of oats and barley. It once belonged to the ancient family of Macdougal, ſtill reſiding on the ſpot; but devolved to the lords of Argyle in conſequence of a marriage with the heireſs, at that time a branch of the Stuart family. The chief place of note in this diſtrict is the caſtle of Dunſtaffnage, a ſeat of the Scottiſh kings previous to the conqueſt of the Picts in 843 by Kenneth II. In this place was long preſerved the famous ſtone, the palladium of North Britain; brought, ſays legend, out of Spain, where it was firſt uſed as a ſeat of juſtice by Gathelus, coeval with Moſes. It continued here as the coronation-chair till the reign of Kenneth II. who removed it to Scone, in order to ſecure his reign; for, according to the inſcription,

Lorne, Lorrain.

Ni fallat fatum, Scoti quocunque locatum
Invenient lapidem, regnare tenentur ibidem.

Some of the ancient regalia were preſerved till the preſent century, when the keeper's ſervants, during his infirm years, embezzled them for the ſilver ornaments; and left only a battle-axe, nine feet long, of beautiful workmanſhip, and ornamented with ſilver.

The caſtle is ſquare; the inſide only 87 feet; partly ruinous, partly habitable. At three of the corners are round towers; one of them projects very little. The entrance is towards the ſea at preſent by a ſtaircaſe, in old times probably by a draw-bridge, which fell from a little gate-way. The maſonry appears very ancient; the tops battlemented. This pile is ſeated on a rock at the mouth of Loch Etive, whoſe waters expand within to a beautiful bay, where ſhips may ſafely ride in all weather. Of this building, the founder of which is unknown, nothing remains except the outer walls, which, though rooſleſs, are ſtill in good order; and within which ſome buildings have been erected, which ſerve as the reſidence of the laird. The duke of Argyle is hereditary keeper under the Crown.—At a ſmall diſtance from the caſtle is a ruined chapel, once an elegant building; and at one end an incloſure, a family-cemetery. Oppoſite to theſe is a high precipice, ending abrupt and turning ſuddenly toward the ſouth-eaſt. A perſon concealed in the receſs of the rock, a little beyond the angle, ſurpriſes friends ſtationed at ſome diſtance beneath the precipice with a very remarkable echo of any word, or even ſentence, he pronounces; which reaches the laſt diſtinct and unbroken. The repetition is ſingle, but remarkably clear.

In 1307, this caſtle was poſſeſſed by Alexander Macdougal lord of Argyle, a friend to the Engliſh; but was that year reduced by Robert Bruce, when Macdougal ſued for peace with that prince, and was received into favour.

We find, about the year 1455, this to have been a reſidence of the lords of the iſles; for here James laſt earl of Douglas, after his defeat in Annandale, fled to Donald, the regulus of the time, and prevailed on him to take arms and carry on a plundering war againſt his monarch James II.

The ſituation of this regal ſeat was calculated for pleaſure as well as ſtrength. The views of mountains, valleys, waters, and iſlands, are delightful. On the north ſide of Loch Etive ſtood the town of Beregonium, ſuppoſed to have been the capital of the Weſt Highlands. It ſeems, from certain mounds, excavations, and other appearances, to have been a ſtrong fortreſs, to prevent invaſion, or to ſecure a retreat, as occaſions might require. On the bank of the ſame loch is the ſite of Ardchattan, a priory of monks of Valliſcaullium in Burgundy, founded in 1230 by Donald Maccoul, anceſtor of the Macdougals of Lorn. Here Robert Bruce, who remained maſter of this country before he got entire poſſeſſion of Scotland, held a parliament or council.—The country abounds in Druidical, Daniſh, and other monuments.

LORRAIN, a ſovereign ſtate of Europe, bounded on the north by Luxemburg and the archbiſhoprick of Treves, on the eaſt by Alſace and the duchy of Deux-

Ponts,

Lorrain, Loten.

Ponts, on the ſouth by Franche Comté, and on the weſt by Champagne and the duchy of Bar. It is about 100 miles in length, and 75 in breadth; and abounds in all ſorts of corn, wine, hemp, flax, rape-ſeed, game, and fiſh, with which it carries on ſome trade, and in general all the neceſſaries of life. There are fine meadows and large foreſts, with mines of iron, ſilver, and copper, as alſo ſalt-pits. There are a great number of rivers; of which the principal are the Maeſe or Meuſe, the Moſelle, the Seille, the Meure, and the Sarre. It is divided into three parts; the duchy of Lorrain, properly ſo called, which was heretofore a ſovereign ſtate; the duchy of Barr, which formerly belonged to the dukes of Lorrain, but afterwards came under the government of France; and the third comprehends the three biſhoprics of Metz, Toul, and Verdun, which have belonged to France ever ſince the year 1552. In 1733, the emperor of Germany being at war with France, this laſt got poſſeſſion of the duchy of Lorrain; and when there was a peace made in 1735, it was agreed, that Staniſlaus king of Poland, father-in-law to the king of France, ſhould poſſeſs theſe duchies, and that after his death they ſhould be united for ever to the crown of France. It was alſo then agreed, that Francis Stephen, duke of Lorrain, and the emperor's ſon-in-law, ſhould have the grand duchy of Tuſcany as an equivalent for Lorrain. After the death of the great duke of Tuſcany, in 1737, King Staniſlaus and the duke of Lorrain took poſſeſſion of their reſpective dominions, and the ceſſation was confirmed and guarantied by a treaty in 1738. The inhabitants are laborious and valiant, and their religion is the Roman Catholic. They have but little trade with ſtrangers, becauſe they have no navigable rivers, and becauſe they have all neceſſaries within themſelves; but what little trade they have conſiſts of corn and linen cloth. Nanci is the capital town.

Lorrain (Robert le), an eminent ſculptor, born at Paris in 1666. From his infancy, he made ſo rapid a progreſs in the art of deſigning, that at the age of 18 the celebrated Girardon intruſted him with the care of teaching his children and correcting his diſciples. He committed to him alſo, in conjunction with Nouliſſon, the execution of the famous tomb of Cardinal Richelieu in the Sorbonne, and his own tomb at St Landres in Paris. On his return from Rome, he finiſhed ſeveral pieces at Marſeilles, which had been left imperfect by the death of Mr Puget. He was received into the academy of ſculpture in 1701. His *chief d'œuvre* is Galatea, a work univerſally admired. Lorrain afterwards made a Bacchus for the gardens at Verſailles, a Faun for thoſe of Marly; and ſeveral bronzes, among which is an Andromeda; all in an excellent taſte. This artiſt ſucceeded chiefly in heads; and more particularly in that of young girls, which he performed with incomparable delicacy and truth.

Lorrain (Claude.) See Claude.

LOTEN (John), a good landſcape painter of the Engliſh ſchool; though a native of Switzerland. His taſte led him to ſolemn and dreary ſcenes, as landſtorms accompanied with ſhowers of rain, &c. and he ſeldom omitted to introduce oak-trees in his proſpects: his landſcapes are generally large; and he painted with nature, truth, and force. But the effect of his compoſition had been much greater if he had been leſs cold in his colouring: for the judicious eye is not pleaſed with the darkiſh tint that predominates in it. He died in London about 1681.

Lothian.

LOTHIAN, a name given to three counties of Scotland, viz. Haddington-ſhire, Edinburgh-ſhire, and Linlithgow-ſhire; otherwiſe called *Eaſt*, *Mid*, and *Weſt* Lothians.

1. East Lothian, or Haddington-ſhire, is bounded on the north-weſt by the Frith of Forth; and on the eaſt by the German Sea; on the ſouth-eaſt by Berwickſhire; and on the weſt by the county of Edinburgh. It extends about 25 miles from eaſt to weſt, and where broadeſt, nearly 15 from north to ſouth. The coaſt, advancing northward into the Frith, forms an irregular curve.—This is one of the moſt fruitful counties in Scotland, producing great quantities of wheat and all ſorts of grain, well-watered, and plentifully ſupplied with fiſh, fowl, fuel, and all the neceſſaries of life. It abounds with towns, villages, and farms, interſperſed with a great number of agreeable houſes belonging to perſons of rank and fortune. For cultivation, populouſneſs, and fertility, this ſhire may vie with any tract of land in the iſland of Great Britain. Over and above the farming, which turns out to great account, the people towards the ſea-coaſt employ themſelves in the fiſhery, ſalt-making, and in foreign trade; and ſome of the more inland inhabitants engage in the linen and woollen manufactures. Limeſtone and coal are found in moſt parts of the country, and great numbers of ſheep are fed on the hills of Lammermuir.

2. Edinburgh-ſhire, or Mid-Lothian, is about 35 miles long, but varies in its breadth in different places from five to 16 miles. It is bounded on the eaſt by Haddington-ſhire; on the weſt by the ſhire of Linlithgow; on the ſouth, by Tweeddale or Peebles-ſhire; and on the north, by part of Weſt-Lothian and the Frith of Forth. The aſpect of the country is in general level and pleaſant, interſperſed with a few hills, that help to exhibit agreeable proſpects. It is well watered with rivers, and ſhaded with woods. It produces plenty of coal, lime-ſtone, a ſoft black marble, and ſome copper ore. The ſoil, of itſelf fertile, is finely cultivated, and yields as plentiful harveſts of excellent wheat as are found in any part of Great Britain. The whole ſhire is interſperſed with noble houſes and plantations belonging to noblemen and gentlemen of fortune. The farmers are maſter of the ſcience of agriculture; and wealthy in conſequence of their ſkill, ſome of them paying 500l. of yearly rent. The country is well inhabited, and preſents us with a good number of towns and populous villages. Along the ſea-coaſt the common people ſubſiſt by fiſhing, and traffic in coals and ſalt, and ſome few carry on a ſmuggling commerce. Thoſe in the inland are employed in farming, and ſome branches of the weaving manufacture. The ſheriffalty of this ſhire is in the gift of the crown; and Edinburgh is a county in itſelf.

3. The ſhire of Linlithgow, or Weſt Lothian, is bounded on the north by the Frith of Forth. The ſmall river Almond divides it from Edinburghſhire on the eaſt. On the ſouth-weſt it joins the county of Lanerk; and on the weſt it is parted from Stirlingſhire by Avon, a ſmall river. Its form, though irregular,

Lotion ‖ Lottery.

regular, approaches to a parallelogram. It meaſures from north-eaſt to ſouth-weſt, nearly 20 miles. Its breadth, except on the ſhore of the Frith, does not exceed 12.—The country is pleaſant and fertile, abounding with corn and paſturage. Here is found plenty of coal, limeſtone, and lead ore; nay, in the reign of James VI. it produced a rich mine of ſilver.

LOTION, is, ſtrictly ſpeaking, ſuch waſhing as concerns beautifying the ſkin, by cleanſing it of thoſe deformities which a diſtempered blood throws upon it. Medicines of this kind, however, are for the moſt part inſignificant, and ſometimes very dangerous; the only proper method of treating theſe diſorders is, by adminiſtering ſuch medicines as tend to correct the morbid ſtate of the conſtitution from whence they ariſe.

LOTION, in pharmacy, denotes a preparation of medicines, by waſhing them in ſome liquid, either made very light, ſo as to take away only the dregs; or ſharp, ſo as to penetrate them, in order to clear them of ſome ſalt, or corroſive ſpirit as is done to antimony, precipitates, magiſteries, &c. or intended to take away ſome foulneſs or ill quality, or to communicate ſome good one.

LOTAPHAGI (anc. geog.), a people of the Regio Syrtica (ſo called from their living on the lotus); inhabiting between the two Syrtes, from the Cinyphus to the Triton. The lotus was ſaid to be a food ſo luſcious, as to make ſtrangers forget their native country. A ſweet wine was expreſſed from it, which did not keep above ten days, (Pliny). Lotophagi of Homer. See MENINX.

LOTTERY, a kind of public game at hazard, frequent in Britain, France, and Holland, in order to raiſe money for the ſervice of the ſtate; being appointed with us by the authority of parliament, and managed by commiſſioners appointed by the lords of the treaſury for that purpoſe. It conſiſts of ſeveral numbers of blanks and prizes, which are drawn out of wheels, one of which contains the numbers, and the other the correſponding blanks or prizes.

The Romans invented lotteries to enliven their Saturnalia. This feſtival began by the diſtribution of tickets which gained ſome prize. Auguſtus made lotteries which conſiſted of things of little value; but Nero eſtabliſhed ſome for the people, in which 1000 tickets were diſtributed daily, and ſeveral of thoſe who were favoured by Fortune got rich by them. Heliogabalus invented ſome very ſingular: the prizes were either of great value or of none at all; one gained a prize of ſix ſlaves, and another of ſix flies; ſome got valuable vaſes, and others vaſes of common earth. A lottery of this kind exhibited an excellent picture of the inequality with which Fortune diſtributes her favours.

The firſt Engliſh lottery we find mentioned in hiſtory was drawn A. D. 1569. It conſiſted of 40,000 lots, at 10s. each lot: the prizes were plate; and the profits were to go towards repairing the havens of this kingdom. It was drawn at the weſt door of St Paul's cathedral. The drawing began on the 11th of January 1569, and continued inceſſantly drawing, *day and night*, till the 6th of May following; as Maitland, from Stowe, informs us in his Hiſtory, Vol. I. p. 257. There were then only *three* lottery-offices in London. The propoſals for this lottery were publiſhed in the years 1567 and 1568. It was at firſt intended to have been drawn at the houſe of Mr Dericke, her majeſty's ſervant (*i. e.* her jeweller), but was afterwards drawn as above mentioned. Lottery.

Dr Rawlinſon ſhowed the Antiquary Society, 1748, "A propoſal for a very rich lottery, general without any blankes, contayning a great number of good prizes, as well of redy money as of plate and certain ſorts of merchandizes, having been valued and priſed by the commandment of the queene's moſt excellent majeſtie's order, to the entent that ſuch commodities as may chance to ariſe thereof after the charges borne may be converted towards the raparations of the havens and ſtrength of the realme, and towards ſuch other public good workes. The number of lotts ſhall be foure hundred thouſand, and no more; and every lott ſhall be the ſum of tenne ſhillings ſterling, and no more. To be filled by the feaſt of St Bartholomew. The ſhew of priſes are to be ſeen in Cheapſide, at the ſign of the Queene's Armes, the houſe of Mr Dericke, goldſmith, ſervant to the queene. Some other orders about it in 1567-8. Printed by Hen. Bynneyman."

"In the year 1612, king James, in ſpecial favour for the preſent plantation of Engliſh colonies in Virginia, granted a lottery, to be held at the weſt end of St Paul's; whereof one Thomas Sharplys, a taylor of London, had the chief prize, which was 4000 crowns in fair plate." Baker's Chronicle.

In the reign of queen Anne, it was thought neceſſary to ſuppreſs lotteries, as nuiſances to the public. Since that time, however, they have been licenſed by an act of parliament, under various regulations. The act paſſed in 1778 reſtrains any perſon from keeping an office for the ſale of tickets, ſhares, or chances, or for buying, ſelling, inſuring, or regiſtering, without a licence; for which licence each office-keeper muſt pay 50l. to continue in force for one year, and the produce to be applied towards defraying the expences of the lottery. And no perſon is allowed to ſell any ſhare or chance leſs than a ſixteenth, on the penalty of 50l. All tickets divided into ſhares or chances are to be depoſited in an office, to be eſtabliſhed in London by the commiſſioners of the treaſury, who are to appoint a perſon to conduct the buſineſs thereof; and all ſhares are to be ſtamped by the ſaid officer, who is to give a receipt for every ticket depoſited with him. The numbers of all tickets ſo depoſited are to be entered in a book, with the names of the owners, and the number of ſhares into which they are divided; and twopence for each ſhare is to be paid to the officer on depoſiting ſuch tickets, who is therewith to pay all expences incident to the office. All tickets depoſited in the office are to remain there three days after the drawing. And any perſon keeping an office, or ſelling ſhares, or who ſhall publiſh any ſcheme for receiving moneys in conſideration of any intereſt to be granted in any ticket in the ſaid lottery, &c. without being in poſſeſſion of ſuch ticket, ſhall forfeit 500l. and ſuffer three months impriſonment. And no buſineſs is to be tranſacted at any of the offices after eight in the evening, except on the evening of the Saturday preceding the drawing. No perſon is to keep any office for the ſale of tickets, &c. in Oxford or Cambridge, on penalty of 20l. Before this regulating ſtatute took place, there were upwards of 400 lottery offices in

Lotus.

and about London only; but the whole number afterwards, for all Britain, as appeared by the liſt publiſhed by authority, amounted to no more than 51.

LOTUS, or BIRD'S-FOOT TREFOIL, in botany: A genus of the decandria order, belonging to the diadelphia claſs of plants; and in the natural method ranking under the 32d order, *Papilionaceæ*. The legumen is cylindrical, and very erect; the alæ cloſing upwards longitudinally; the calyx is tubulated. There are many ſpecies, but only five or ſix are uſually cultivated in our gardens. 1. The tetragonolobus, or winged pea, hath trailing, ſlender, branchy ſtalks, about a foot long, garniſhed with trifoliate oval leaves; and, from the axillas of the branches, large, papilionaceous red flowers, one on each footſtalk; ſucceeded by tetragonous ſolitary pods, having a membranous wing or lobe, running longitudinally at each corner. It flowers in June and July, and the ſeeds ripen in autumn. 2. The creticus, or Cretan ſilvery lotus, hath a ſlender under ſhrubby ſtalk, riſing by ſupport three or four feet high, ornamented with trifoliate, bright, ſilvery leaves; and branches terminated by ſeveral yellow flowers ſucceeded by ſubternate pods. 3. The Jacobæus, or lotus of St James's iſland, hath upright herbaceous ſtalks branching two or three feet high, and, from the upper part of the branches, long ſlender footſtalks, terminated each by three or five yellowiſh purple flowers, appearing moſt part of the ſummer and autumn, and ſucceeded by ſubternate pods filled with plenty of ſeeds. 4. The hirſutus, or hairy Italian lotus, hath upright hairy ſtalks branching a yard high; and terminated by heads of whitiſh hoary-cupped flowers appearing in June, which are ſucceeded by oval pods full of ſeed, which ripens in autumn. 5. The dorcynium, white Auſtrian lotus, or ſhrub-trefoil of Montpelier, has underſhrubby ſmooth ſtalks, branching three or four feet high, and the branches terminated by aphyllous heads of ſmall white flowers appearing in June, ſucceeded by ſhort pods. 6. The edulis, ſends forth ſeveral trailing ſtalks about a foot long, furniſhed at their joints with trifoliate, roundiſh, ſmooth leaves, having oval ſtipulæ. The flowers come ſingly from the ſides of the ſtalks, on long peduncles, with three oval floral leaves, the length of the flower: the latter is ſmall, yellow; and is ſucceeded by a thick arched pod, having a deep furrow on its outſide.

Culture, &c. The firſt ſpecies is a hardy annual, and is eaſily raiſed from ſeed ſown any time from the month of February to May; the plants requiring no other culture than to be kept free from weeds. It was formerly cultivated as an eſculent; for its young green ſeed-pods may be dreſſed and eat like peaſe, or in the manner of kidney-beans. The other ſpecies may be propagated either by ſeeds or cuttings, but require to be kept in pots in the green-houſe during the winter-ſeaſon. —— The ſixth ſpecies is an annual, and a native of ſeveral parts of Italy, where the inhabitants eat the young pods as we do kidney beans. The green pods of the firſt ſpecies were formerly gathered in this country, and dreſſed in the manner of kidney beans, and are uſed ſo ſtill in ſome of the northern counties of England; but they are coarſe, and not very agreeable to ſuch as have been accuſtomed to feed upon better fare.

Lovage, Love.

Lotus of Homer. See DIOSPYROS.

Egyptian Lotus. See NYMPHÆA.

Libyan Lotus. See RHAMNUS.

LOVAGE, in botany. See LIGUSTICUM.

LOVE, in a large ſenſe of the word, denotes all thoſe affections of the pleaſing kind which objects and incidents raiſe in us: thus we are ſaid to *love* not only intelligent agents of morally good diſpoſitions, but alſo ſenſual pleaſures, riches, and honours. But

LOVE, in its uſual and more appropriate ſignification, may be defined, "that affection which, being compounded of animal deſire, eſteem, and benevolence, becomes the bond of attachment and union between individuals of the different ſexes; and makes them feel in the ſociety of each other a ſpecies of happineſs which they experience no where elſe." We call it an *affection* rather than a *paſſion*, becauſe it involves a deſire of the happineſs of its object: And that its conſtituent parts are thoſe which have been juſt enumerated, we ſhall firſt endeavour to prove, and then proceed to trace its riſe and progreſs from a ſelfiſh appetite to a generous ſentiment

Animal deſire is the actual energy of the ſenſual appetite: and that it is an eſſential part of the complex affection, which is properly called *love*, is apparent from this conſideration, that though a man may have ſentiments of eſteem and benevolence towards women who are both old and ugly, he never ſuppoſes himſelf to be in love of any woman, to whom he feels not the ſenſual appetite to have a ſtronger tendency than to other individuals of her ſex. On the other hand, that animal deſire *alone* cannot be called the affection of love is evident; becauſe he who gratifies ſuch a deſire without eſteeming its object, and wiſhing to communicate at the ſame time that he receives enjoyment, loves not the woman, but himſelf. Mere animal deſire has nothing in view but the ſpecies and the ſex of its object; and before it make a ſelection, it muſt be combined with ſentiments very different from itſelf. The firſt ſentiment with which it is combined, and by which a man is induced to prefer one woman to another, ſeems to be that by which we are delighted with gracefulneſs of perſon, regularity of features, and beauty of complexion. It is not indeed to be denied that there is ſomething irreſiſtible in female beauty. The moſt ſevere will not pretend, that they do not feel an immediate prepoſſeſſion in favour of a handſome woman; but this prepoſſeſſion, even when combined with animal deſire, does not conſtitute the whole of that affection which is called *love*. Savages feel the influence of the ſenſual appetite, and it is extremely probable that they have ſome ideas of beauty; but among ſavages the affection of love is ſeldom felt. Even among the lower orders in civil ſociety it ſeems to be a very groſs paſſion, and to have in it more of the ſelfiſhneſs of appetite than of the generoſity of eſteem. To theſe obſervations many exceptions will no doubt be found (A): but

(A) Such as the negroes whoſe ſtory is ſo pathetically told by Addiſon in N° 215 of the Spectator; the two lovers who were killed by lightning at Staunton Harcourt, Auguſt 9th, 1718, (ſee *Pope's Letters*); and many others which will occur to every reader.

Love. but we ſpeak of ſavages in general, and of the great body of the labouring poor, who in the choice of their mates do not ſtudy—who indeed are incapable of ſtudying, that rectitude of mind and thoſe delicacies of ſentiment, without which neither man nor woman can deſerve to be eſteemed.

In the ſavage ſtate, and even in the firſt ſtages of refinement, the bond of union between the ſexes ſeems to conſiſt of nothing more than mere animal deſire and inſtinctive tenderneſs for their infant progeny. The former impels them to unite for the propagation of the ſpecies; and the latter preſerves the union till the children, who are the fruit of it, be able to provide for their own ſubſiſtence. That in ſuch unions, whether caſual or permanent, there is no mutual eſteem and benevolence, is apparent from the ſtate of ſubjection in which women are held in rude and uncultivated nations, as well as from the manner in which marriages are in ſuch nations contracted.

Sweetneſs of temper, a capital article with us in the female character, diſplays itſelf externally in mild looks and gentle manners, and is the firſt and perhaps the moſt powerful inducement to love in a cultivated mind. "But ſuch graces (ſays an ingenious writer*) are ſcarce diſcernible in a female ſavage; and even in the moſt poliſhed woman would not be perceived by a male ſavage. Among ſavages, ſtrength and boldneſs are the only valuable qualities. In theſe, females are miſerably deficient; for which reaſon they are contemned by the males as beings of an inferior order. The North American tribes glory in idleneſs: the drudgery of labour degrades a *man* in their opinion, and is proper for *women* only. To join young perſons in marriage is accordingly the buſineſs of the parents; and it would be unpardonable *meanneſs* in the bridegroom to ſhow any *fondneſs* for the bride. In Guiana a woman never eats with her *huſband*, but after every meal attends him with water for waſhing; and in the Caribbee iſlands ſhe is not permitted to eat even in the *preſence* of her huſband. Dampier obſerves in general, that among all the wild nations with which he was acquainted, the women carry the burdens, while the men walk before and carry nothing but their arms; and that women even of the higheſt rank are not better treated. In Siberia, and even in Ruſſia, the capital excepted, men till very lately treated their wives in every reſpect like ſlaves. It might indeed be thought, that animal deſire, were there nothing elſe, ſhould have raiſed women to ſome degree of eſtimation among men; but male ſavages, utter ſtrangers to decency and refinement, gratify animal deſire with as little ceremony as they do hunger or thirſt.

* *Sketches of the Hiſtory of Man.*

"Hence it was that in the early ages of ſociety a man *purchaſed* a woman to be his wife as one purchaſes an ox or a ſheep to be food; and valued her only as ſhe contributed to his ſenſual gratification. Inſtances innumerable might be collected from every nation of which we are acquainted with the early hiſtory; but we ſhall content ourſelves with mentioning a few. Abraham bought Rebekah and gave her to his ſon Iſaac for a wife‡. Jacob having nothing elſe to give, ſerved Laban 14 years for two wives†. To David, demanding Saul's daughter in marriage, it was ſaid, "The king deſireth not any dowry, but an hundred foreſkins of the Philiſtines‡." In the Iliad Agamemnon offers his daughter to Achilles for a wife; and ſays that he would not demand for her any *price* §. By the laws of Ethelbert king of England, a man who committed adultery with his neighbour's wife was obliged to pay the huſband a fine, and to *buy him another wife.*‖" But it is needleſs to multiply inſtances; the practice has prevailed univerſally among nations emerging from the ſavage ſtate, or in the rudeſt ſtage of ſociety: and wherever it prevailed, men could not poſſibly have for the fair ſex any of that tender regard and eſteem which conſtitute ſo eſſential a part of the complex affection of love.

‡ Gen. xxi.

† Gen. xxix.

‡ 1 Sam. xviii. 28.

§ Lib. ix. Sect. 32.

Accordingly we find the magnanimous Achilles an abſolute ſtranger to that generous affection, though his heart was ſuſceptible of the warmeſt and pureſt friendſhip. His attachment to Patroclus was ſo heroically diſintereſted, that he willingly ſacrificed his own life to revenge the death of his friend; but when Agamemnon threatened to rob him of his favourite female captive, though he felt the inſult offered to his *pride*, he never ſpoke of the *woman* but as a *ſlave* whom he was concerned to preſerve in point of *honour*, and as a teſtimony of his *glory*. Hence it is that we never hear him mention her but as his *ſpoil*, the *reward of war*, or the *gift* which the Grecians gave him.

"And dar'ſt thou threat to ſnatch my *prize* away,
"Due to the deeds of many a dreadful day?
"A *prize* as *ſmall*, O tyrant! match'd with thine,
"As thy own actions if compar'd with mine.
"Thine in each conqueſt is the *wealthy prey*,
"Tho' mine the ſweat and danger of the day.
"Some *trivial preſent* to my ſhips I bear,
"Or barren praiſes pay the wounds of war."

And again, after upbraiding the general with his tyranny and want of regard to merit, he adds, with the greateſt indifference as to the charms of the *woman*,

"Seize on Briſeis, whom the Grecians doom'd
"My *prize of war*, yet tame'y ſee *reſum'd*;
"And ſeize ſecure; no more Achilles draws
"His conquering ſword in any woman's cauſe.
"The gods command me to forgive the paſt;
"But let this firſt *invaſion* be the laſt:
"For know, thy blood, when *next* thou dar'ſt *invade*,
"Shall ſtream in vengeance on my reeking blade."

Pope has made the language of this rough warrior leſs inconſiſtent with the peculiar reſentment natural to an injured lover than it is in the original (B); but from

(B) The original paſſages are:

Και δη μοι γερας αυλος αφαιρησεισθαι απειλεις,
Ωι επι πολλ' εμογησα, δοσαν δε μοι υιες Αχαιων.
Ου μεν σοι πολε ισον εχω γερας, οππot Αχαιοι
Τρωων εκπερσω ευναιομενον πτολιεθρον.
Αλλα το μεν πλειον πολυαικος πολεμοιο
Χειρες εμαι διεπουσ αταρ ην πολε δασμος ικηαι,
Σοι το γερας πολυ μειζον, εγω δ'ολιγον τε φιλον τε
Ερχομ ηχων επι νηας επην κεκαμω πολεμιζων.

Iliad, Lib. I.

And, Αλλο δε τοι ερεω, συ δ'ενι φρεσι βαλλεο σησιν
Χερσι μεν ουτι εγωγε μαχησομαι, εινεκα κουρης,
Ουτε σοι, ου τω αλλω, επει μ'αφελισθε γε δονθις.
Των δ'αλλων, α μοι εσθι θοη παραννι μελαινη,
Των ουκ αν τι φεροις ανελων, αεκοντος εμειο.
Ει δ'αγε μην, πειρησαι, ινα γνωωσι και οιδε
Αιψα τοι αιμα χελαινον ερωησει περι δουρι.

In this latter paſſage the hero ſays expreſsly, "I will not fight with you or with any other man for the ſake of a *girl*; but you ſhall not rob me of any other part of my *property*:" which is ſurely the language of a man to whoſe heart love muſt have been an utter ſtranger.

Love. the laſt quoted paſſage, even as tranſlated by him, it is apparent that Achilles would have been equally hurt had Agamemnon threatened to deprive him of any other part of his plunder. Accordingly he yields up Briſeis, not in grief for a miſtreſs whom he loſes, but in ſullenneſs for an injury that is done him. Nor let it be imagined, that this coldneſs proceeded from the pride of the hero, which would not permit him to acknowledge his love of a captive. With the generous affection of love captives and princeſſes were equally incapable of inſpiring him. He repeatedly affirmed indeed that he delighted in his fair Lyrneſſian ſlave, but it was only as an inſtrument of ſenſual gratification; for as to every thing elſe in a woman, he was ſo totally indifferent, that he declared he would not, when he ſhould be diſpoſed to marry, give himſelf the trouble to make a *choice*, but leave the whole matter to his father.

"If heav'n reſtore me to my realms with life,
"The rev'rend Peleus ſhall elect my wife."

Even Agamemnon, of whom Pope and Madam Dacier think more favourably as a lover, ſpeaks the very ſame language when mentioning his favourite captive Chryſeis. In his furious debate with Achilles he calls her indeed

"A maid, unmatch'd in manners as in face,
"Skill'd in each art, and crown'd with ev'ry grace."

And adds,

"Not half ſo dear were Clytemneſtra's charms,
"When firſt her blooming beauties bleſt my arms."

But this was ſaid merely to enhance the value of the *prize*, which for the public good he was about to reſign; for that ſhe was dear to him only as miniſtring to his pleaſure, is paſt diſpute from the language which he had previouſly held with her father, as well as from his requiring grateful Greece to pay a juſt *equivalent*, and to repair his *private loſs*. A man who really *loved* would have thought nothing an *equivalent* for the object of his love; much leſs would he have inſinuated to her father a poſſibility of his diſmiſſing from his embrace a woman whom he eſteemed, when time ſhould have robbed her of every youthful grace.

Since, then, it is ſo apparent, that in the heroic age of Greece even princes and kings were ſtrangers to the generous affection of love, it needs not occaſion much ſurpriſe that the ſame affection has very little influence upon mankind in the loweſt ranks of the moſt poliſhed ſocieties of modern Europe. That this is actually the caſe, that among the generality of uneducated men and women there is no other bond of attachment than the ſenſual appetite, every year furniſhes multiplied proofs. We daily ſee youths, rejected by their miſtreſſes, paying their addreſſes without delay to girls who, in looks, temper, and diſpoſition, are diametrically oppoſite to thoſe whom ſo lately they pretended to love: We daily ſee maidens, ſlighted by their lovers, receiving the addreſſes of men, who, in nothing but their ſex, reſemble thoſe to whom a week before they wiſhed to be married: and we believe it is not very uncommon to find a girl entertaining ſeveral lovers together, that if one or more of them ſhould prove falſe, ſhe may ſtill have a chance not to be totally deſerted. Did eſteem and benevolence, placed on manners and character, conſtitute any part of vulgar love, theſe people would act very differently; for they would find it impoſſible to change their lovers and their miſtreſſes with the ſame eaſe that they change their cloaths Love.

To this account of love, as it appears in ſavage nations, ſome one may perhaps oppoſe the paintings of the ſofter paſſion in the poems of Oſſian. That bard deſcribes the female character as commanding reſpect and eſteem, and the Caledonian heroes as cheriſhing for their miſtreſſes a flame ſo pure and elevated as never was ſurpaſſed, and has ſeldom been equalled, in thoſe ages which we commonly call moſt enlightened. This is indeed true: and it is one of the many reaſons which have induced Johnſon and others to pronounce the whole a modern fiction. Into that debate we do not enter. We may admit the authenticity of the poems, without acknowledging that they furniſh any exception to our general theory. They furniſh indeed in the manners which they deſcribe a wonderful anomaly in the general hiſtory of man. All other nations of which we read were in the hunter-ſtate ſavage and cruel. The Caledonians, as exhibited by Oſſian, are gentle and magnanimous. The heroes of Homer fought for plunder, and felt no clemency for a vanquiſhed foe. The heroes of Oſſian fought for fame; and when their enemies were ſubdued, they took them to their boſoms. The firſt of Greeks committed a mean inſult on the dead body of the firſt of Trojans. Among the Caledonians inſults offered to the dead, as well as cruelty to the living, were condemned as infamous. The heroes of Oſſian appear in no inſtance as ſavages. How they came to be poliſhed and refined before they were acquainted with agriculture and the moſt uſeful arts of life, it is not our buſineſs to enquire; but ſince they unqueſtionably were ſo, their treatment of the female ſex, inſtead of oppoſing, confirms our theory; for we never conceived rich cloaths, ſuperb houſes, highly-dreſſed food, or even the knowledge of foreign tongues, to be neceſſary to the acquiſition of a generous ſentiment. Luxury indeed appears to be as inimical to love as barbariſm: and we believe, that in modern nations the tender and exalted affection which deſerves that name is as little known among the higheſt orders of life as among the loweſt. Perhaps the Caledonian ladies of Oſſian reſembled in their manners the German ladies of Tacitus, who accompanied their huſbands to the chace, fought by their ſides in battle, and partook with them of every danger. If ſo, they could not fail to be reſpected by a race of heroes among whom courage took place of all other virtues: and this ſingle circumſtance, from whatever cauſe it might proceed, will ſufficiently account for the eſtimation of the female character among the ancient Germans and Caledonians, ſo different from that in which it has been held in almoſt every other barbarous nation. Love.

But if among ſavages and the vulgar, love be unknown, it cannot poſſibly be an inſtinctive affection: and therefore it may be aſked, How it gets poſſeſſion of the human heart; and by what means we can judge whether in any particular inſtance it be real or imaginary? Theſe queſtions are of importance, and deſerve to be fully anſwered; though many circumſtances conſpire to render it no eaſy taſk to give to them ſuch anſwers as ſhall be perfectly ſatisfactory. Love can ſubſiſt only between *individuals* of the different ſexes. A man can hardly *love two women* at the ſame time;

Love. and we believe that a woman is ſtill *leſs* capable of *loving at once more than one man*. Love, therefore, has a natural tendency to make men and women pair, or, in other words, it is the ſource of marriage: but in poliſhed ſociety, where alone this affection has any place, ſo many things beſides mutual attachment are neceſſary to make the married life comfortable, that we rarely ſee young perſons uniting from the impulſe of love, and have therefore but few opportunities of tracing the riſe, progreſs, and conſequences of the affection. We ſhall, however, throw together ſuch reflections as have occurred to us on the ſubject, not without indulging a hope, that they may be uſeful to the younger part of our readers when forming the moſt important connection in life.

We have ſaid, that the perception of beauty, combined with animal deſire, is the firſt inducement which a man can have to prefer one woman to another. It may be added, that elegance of figure, a placid maſculine countenance, with a perſon which indicates ſtrength and agility, are the qualities which firſt tend to attach any woman to a particular man. Beauty has been defined ‡, "That particular form, which is the moſt common of all particular forms to be met with in the ſame ſpecies of beings." Let us apply this definition to our own ſpecies, and try, by means of it, to aſcertain what conſtitutes the beauty of the human face. It is evident, that of countenances we find a number almoſt infinite of different forms, of which forms one only conſtitutes beauty, whilſt the reſt, however numerous, conſtitute what is *not beauty*, but *deformity*, or *uglineſs*. To an attentive obſerver, however, it is evident, that of the numerous particular forms of *uglineſs*, there is not one which includes ſo many faces as are formed after that particular caſt which conſtitutes *beauty*. Every particular ſpecies of the animal as well as of the vegetable creation, may be ſaid to have a fixed or determinate form, to which, as to a centre, nature is continually inclining. Or it may be compared to pendulums vibrating in different directions over one central point; and as they *all* croſs the *centre*, though only *one* paſſes through any *other point*; ſo it will be found that *perfect beauty* is oftener produced by nature than deformity: we do not mean than deformity in *general*, but than any *one kind* and *degree* of deformity. To inſtance in a particular part of a human feature: the line which forms the ridge of the noſe is deemed beautiful when it is *ſtraight*; but this is likewiſe the *central* form, which is oftener found than any one *particular degree* of *concave*, *convex*, or any *other* irregular form that ſhall be propoſed. As we are then more accuſtomed to beauty than deformity, we may conclude *that* to be the reaſon why we approve and admire it, juſt as we approve and admire faſhions of dreſs for no other reaſon than that we are uſed to them. The ſame thing may be ſaid of colour as of form: it is cuſtom alone which determines our preference of the colour of the *Europeans* to that of the *Ethiopians*, and which makes them prefer their own colour to ours; ſo that though habit and cuſtom cannot be the *cauſe* of beauty (ſee BEAUTY), they are certainly the cauſe of our liking it.

That we *do like it* cannot be denied. Every one is conſcious of a pleaſing emotion when contemplating beauty either in man or woman; and when that pleaſure is combined with the gratification of the ſenſual appetite, it is obvious that the ſum of enjoyment muſt be greatly increaſed. The perception of beauty, therefore, neceſſarily directs the energy of the ſenſual appetite to a *particular* object; but ſtill this combination is a mere ſelfiſh feeling, which regards its object only as the *beſt* of many *ſimilar* inſtruments of pleaſure. Before it can deſerve the name of *love*, it muſt be combined with eſteem, which is never beſtowed but upon moral character and internal worth; for let a woman be ever ſo beautiful, and of courſe ever ſo deſirable as an inſtrument of ſenſual gratification, if ſhe be not poſſeſſed of the virtues and diſpoſitions which are peculiar to her ſex, ſhe will inſpire no man with a generous affection. With regard to the outlines, indeed, whether of internal diſpoſition or of external form, men and women are the ſame; but nature, intending them for mates, has given them diſpoſitions, which, though concordant, are, however, different, ſo as to produce together delicious harmony. "The man, more rebuſt, is fitted for ſevere labour, and for field exerciſes; the woman, more delicate, is fitted for ſedentary occupations, and particularly for nurſing children. The man, bold and vigorous, is qualified for being a protector ‡; the woman, delicate and timid, requires protection. Hence it is, that a man never admires a woman for poſſeſſing bodily ſtrength or perſonal courage; and women always deſpiſe men who are totally deſtitute of theſe qualities. The man, as a protetor, is directed by nature to govern; the woman, conſcious of inferiority, is diſpoſed to obey. Their intellectual powers correſpond to the deſtination of nature. Men have penetration and ſolid jndgment to fit them for governing; women have ſufficient underſtanding to make a decent figure under good government: a greater proportion would excite dangerous rivalſhip between the ſexes, which nature has avoided by giving them different talents. Women have more imagination and ſenſibility than men, which make all their enjoyments more exquiſite; at the ſame time that they are better qualified to communicate enjoyment. Add another capital difference of diſpoſition: the gentle and inſinuating manners of the female ſex tend to ſoften the roughneſs of the other ſex; and wherever women are indulged with any freedom, they poliſh ſooner than men.

"Theſe are not the only particulars that diſtinguiſh the ſexes. With reſpect to the ultimate end of love, it is the privilege of the male, as ſuperior and protector, to make a choice: the female, preferred, has no privilege but barely to conſent or to refuſe. Whether this diſtinction be the immediate reſult of the originally different diſpoſitions of the ſexes, or only the effect of aſſociations inevitably formed, may be queſtioned; but among all nations it is the practice for men to court, and for women to be courted: and were the moſt beautiful woman on earth to invert this practice, ſhe would forfeit the eſteem, however by her external grace ſhe might excite the deſire, of the man whom ſhe addreſſed. The great moral virtues which may be comprehended under the general term *integrity*, are all abſolutely neceſſary to make either men or women eſtimable; but to procure eſteem to the female character, the modeſty peculiar to their ſex is a very eſſential circumſtance. Nature hath provided them with it as a defence againſt the artful ſolicitations of the other ſex

‡ By Pere Buffier in his *Firſt Truths*, and Sir Joſhua Reynolds in the *Idler*.

‡ *Sketches of Man.*

Love. ſex before marriage, and alſo as a ſupport of conjugal fidelity."

A woman, therefore, whoſe diſpoſitions are gentle, delicate, and rather timid than bold, who is poſſeſſed of a large ſhare of ſenſibility and modeſty, and whoſe manners are ſoft and inſinuating, muſt, upon moral principles (ſee MORAL PHILOSOPHY), command the eſteem and benevolence of every individual of the other ſex who is poſſeſſed of ſound underſtanding; but if her perſon be deformed, or not ſuch as to excite ſome degree of animal deſire, ſhe will attract no man's love. In like manner, a man whoſe moral character is good, whoſe underſtanding is acute, and whoſe converſation is inſtructive, muſt command the eſteem of every ſenſible and virtuous woman; but if his figure be diſagreeable, his manners unpoliſhed, his habits ſlovenly, and above all, if he be deficient in perſonal courage, he will hardly excite deſire in the female breaſt. It is only when the qualities which command eſteem are, in the ſame perſon, united with thoſe which excite deſire, that the individual ſo accompliſhed can be an object of love to one of the other ſex; but when theſe qualities are thus united, each of them increaſes the other in the imagination of the lover. The beauty of his miſtreſs gives her, in his apprehenſion, a greater ſhare of gentleneſs, modeſty, and every thing which adorns the female character, than perhaps ſhe really poſſeſſes; whilſt his perſuaſion of her internal worth makes him, on the other hand, apprehend her beauty to be abſolutely unrivalled.

To this theory an objection readily offers itſelf, which it is incumbent upon us to obviate. Men and women ſometimes fall in love at firſt ſight, and very often before they have opportunities of forming a juſt eſtimate of each other's moral character: How is this circumſtance to be reconciled with the progreſſive generation of love? We anſwer, By an aſſociation of ideas which is formed upon principles of phyſiognomy. Every paſſion and habitual diſpoſition of mind gives a particular caſt to the conntenance, and is apt to diſcover itſelf in ſome feature of the face. This we learn by experience; and in time, without any effort of our own, the idea of each particular caſt of countenance comes to be ſo cloſely aſſociated in our minds with the internal diſpoſition which it indicates, that the one can never afterwards be preſented to our view without inſtantly ſuggeſting the other to the imagination. (See METAPHYSICS and PHYSIOGNOMY). Hence it is that every man, who has been accuſtomed to make obſervations, naturally forms to himſelf, from the features and lineaments of a ſtranger's face, ſome opinion of his character and fortune. We are no ſooner preſented to a perſon for the firſt time, than we are immediately impreſſed with the idea of a proud, a reſerved, an affable, or a good-natured man; and upon our going into a company of abſolute ſtrangers, our benevolence or averſion, our awe or contempt, riſes inſtantly towards particular perſons, before we have heard them ſpeak a word, or know ſo much as their names or deſignations. The ſame thing happens when we are preſented to the fair ſex. If a woman, ſeen for the firſt time, have that particular caſt of countenance, and that expreſſion of features, to which we have aſſociated notions of *gentleneſs*, *modeſty*, and other female virtues, ſhe inſtantly commands our *eſteem*; and if ſhe have likewiſe ſo much *beauty* as to make her an object of particular *deſire*, eſteem and deſire become ſuddenly combined; and that combination conſtitutes the affection of love. Such, too, is the nature of all mental aſſociations, that each part of which they are compoſed adds ſtrength and vividneſs to the other parts; ſo that, in the preſent inſtance, deſire makes us imagine virtues in the woman which her countenance perhaps does not indicate; and the virtues which are there actually viſible, make us apprehend her beauty as more perfect than it is. Love.

The affection thus generated is more or leſs pure, and will be more or leſs permanent, according as the one or the other part of which it is compounded predominates. "Where deſire of poſſeſſion || prevails over || our eſteem of the perſon and merits of the deſirable object, love loſes its benevolent character: the appetite for gratification becomes ungovernable, and tends violently to its end, regardleſs of the miſery that muſt follow. In that ſtate love is no longer a ſweet agreeable affection; it becomes a ſelfiſh, painful paſſion, which, like hunger and thirſt, produceth no happineſs but in the inſtant of fruition; and when fruition is over, diſguſt and averſion generally ſucceed to deſire. On the other hand, where eſteem, founded on a virtuous character and gentle manners, prevails over animal deſire, the lover would not for the world gratify his appetite at the expence of his miſtreſs's honour or peace of mind. He wiſhes, indeed, for enjoyment; and to him enjoyment is more exquiſite than to the mere ſenſual lover, becauſe it unites ſentiment with the gratification of ſenſe; at the ſame time that, ſo far from being ſucceeded by diſguſt or averſion, it increaſes his benevolence to the woman, whoſe character and manners he eſteems, and who has contributed ſo much to his pleaſure. Benevolence to an individual, having a general end, admits of acts without number, and is ſeldom fully accompliſhed. Hence mutual love, which is compoſed chiefly of eſteem and benevolence, can hardly be of a ſhorter duration than its objects. Frequent enjoyment endears ſuch lovers to each other, and makes conſtancy a pleaſure; and when the days of ſenſual enjoyment are over, eſteem and benevolence will remain in the mind, making ſweet, even in old age, the ſociety of that pair, in whom are collected the affections of huſband, wife, lover, friend, the tendereſt affections of human nature." *Sketches of Man.*

From the whole of this inveſtigation, we think it appears, that the affection between the ſexes which deſerves the name of *love*, is inſeparably connected with virtue and delicacy; that a man of looſe morals cannot be a faithful or a generous lover; that in the breaſt of him who has ranged frnm woman to woman for the mere gratification of his ſenſual appetite, deſire muſt have effaced all eſteem for the female character; and that, therefore, the maxim too generally received, "that a reformed rake makes the beſt huſband," has very ſeldom a *chance* to be true. We think it may likewiſe be inferred, that thouſands fancy themſelves in love who know not what love is, or how it is generated in the human breaſt: and therefore we beg leave to adviſe ſuch of our readers as may imagine themſelves to be in that ſtate, to examine their own minds, with a view to diſcover, whether, if the objects of their love were old or ugly, they would ſtill eſteem

Love. them for the virtues of their character, and the propriety of their manners. This is a queſtion which deſerves to be well weighed by the young and the amorous, who, in forming the matrimonial connection, are too often blindly impelled by mere animal deſire inflamed by beauty. "It may indeed happen‡, after the pleaſure of gratifying that deſire is gone (and if not refined by eſteem and benevolence, go it muſt with a ſwift pace), that a new bond of attachment may be formed upon more dignified and more laſting principles; but this is a dangerous experiment. Even ſuppoſing good ſenſe, good temper, and internal worth of every ſort, yet a new attachment upon ſuch qualifications is rarely formed; becauſe it *commonly*, or rather *always*, happens, that ſuch qualifications, the only ſolid foundation of an indiſſoluble connection, if they did not originally make eſteem predominate over animal deſire, are afterwards rendered altogether inviſible by ſatiety of enjoyment creating diſguſt."

‡ *Elements of Criticiſm.*

Love, in medicine. The ſymptoms produced by this paſſion as a diſeaſe, according to medical writers, are as follow: The eye-lids often twinkle; the eyes are hollow, and yet appear as if full with pleaſure: the pulſe is not peculiar to the paſſion, but the ſame with that which attends ſolicitude and care. When the object of this affection is thought of, particularly if the idea is ſudden, the ſpirits are confuſed, the pulſe changes, and its force and time are very variable: in ſome inſtances, the perſon is ſad and watchful; in others, the perſon, not being conſcious of his ſtate, pines away, is ſlothful, and regardleſs of food; though the wiſer, when they find themſelves in love, ſeek pleaſant company and active entertainments. As the force of love prevails, ſighs grow deeper; a tremor affects the heart and pulſe; the countenance is alternately pale and red; the voice is ſuppreſſed in the fauces; the eyes grow dim; cold ſweats break out; ſleep abſents itſelf, at leaſt until the morning; the ſecretions become diſturbed; and a loſs of appetite, a hectic fever, melancholy, or perhaps madneſs, if not death, conſtitutes the ſad cataſtrophe. On this ſubject the curious may conſult Ægineta, lib. iii. cap. 17. Oribat. Synop. lib. viii. cap. 9. or a treatiſe profeſſedly written on love, as it is a diſtemper, by James Ferrard, Oxford, printed 1640.

The manner of the Greeks and Romans were ſimilar to each other in the affairs of love. They generally made a diſcovery of their paſſion, by writing upon trees, walls, doors, &c. the name of their beloved. They uſually decked the door of their dulcinea with flowers and garlands, made libations of wine before their houſes, ſprinkling the poſts with the ſame liquor, as if the object of their affection was a real goddeſs. For a man's garland to be untied, and for a woman to compoſe a garland, were held to be indubitable indications of their love.

When their love was without ſucceſs, they uſed ſeveral arts to excite affection in the object of their deſire. They had recourſe to inchantreſſes, of whom the Theſſalian were in the higheſt eſtimation.—The means made uſe of were moſt commonly philtres or love potions, the operation of which was violent and dangerous, and frequently deprived ſuch as drank them of their reaſon. Some of the moſt remarkable ingredients of which they were compoſed were theſe: the hippomanes, the jynx, inſects bred from putrefaction, the fiſh remora, the lizard, brains of a calf, the hairs on the tip of a wolf's tail, his ſecret parts, the bones of the left ſide of a toad eaten with ants, the blood of doves, bones of ſnakes, feathers of ſcritch-owls, twiſted cords of wool in which a perſon had hanged himſelf, rags, torches, reliques, a neſt of ſwallows buried and famiſhed in the earth, bones ſnatched from hungry bitches, the marrow of a boy famiſhed in the midſt of plenty, dried human liver; to theſe may be added ſeveral herbs growing out of putrid ſubſtances. Such were the ingredients that entered into the compoſition of that infernal draught a *love potion*.

Love, Loventinum.

But, beſides the philtres, various other arts were uſed to excite love, in which the application of certain ſubſtances was to have a magical influence on the perſon againſt whom they levelled their ſkill. A hyæna's udder worn under the left arm, they fancied would draw the affections of whatever woman they fixed their eyes upon. That ſpecies of olives called πίλυρα, and barley-bran made up into a paſte, and thrown into the fire, they thought would excite the flame of love. Flour was uſed with the ſame intention. Burning laurel, and melting wax, were ſuppoſed to have the like effect. When one heart was to be hardened, and another mollified, clay and wax were expoſed to the ſame fire together. Images of wax were frequently uſed, repreſenting the perſons on whom they wiſhed to make an impreſſion; and whatever was done to the ſubſtitute of wax, they imagined was felt by the perſon repreſented. Enchanted medicaments were often ſprinkled on ſome part of the houſe where the perſon reſided. Love-pledges were ſuppoſed to be of ſingular uſe and efficacy: theſe they placed under their threſhold, to preſerve the affections of the owner from wandering. Love-knots were of ſingular power, and the number three was particularly obſerved in all they did. But no good effect was expected, if the uſe of theſe things was not attended with charms or magical verſes and forms of words. See MAGIC.

Having mentioned their arts of exciting love, it may not be amiſs to take notice, that the ancients imagined, that love excited by magic might be allayed by more powerful ſpells and medicaments, or by applying to demons more powerful than thoſe who had been concerned in raiſing that paſſion. But love inſpired without magic had no cure; Apollo himſelf could find no remedy, but cried out

Hei mihi quod nullis amor eſt medicabilis herbis.

The antidotes againſt love were generally *agnus caſtus*, which has the power of weakening the generative faculty; ſprinkling the duſt in which a mule had rolled herſelf; tying toads in the hide of a beaſt newly ſlain; applying amulets of minerals or herbs, which were ſuppoſed of great efficacy in other caſes; and invoking the aſſiſtance of the infernal deities. Another cure for love was bathing in the waters of the river Selemnus; to which we may add the lover's leap, or jumping down from the Leucadian promontory.

Love-Apple. See SOLANUM.

LOVENTINUM, or LUENTINUM, (anc. geog.) a town of the Demeta in Britain, near the mouth of the Tucrobis or Tivy. Suppoſed to have been afterwards

Loughborough || Loughneach.

wards ſwallowed up by an earthquake, and to have ſtood where is now the lake called *Lin Savatan* in Brecknockſhire.

LOUGHBOROUGH, a town of Leiceſterſhire in England, 110 miles from London. It is the ſecond town in the county, and was in the Saxons time a royal village. Its market is on Thurſday; and its fairs are on April 25th, May 28th, Auguſt 1ſt, and November 2d. It has a large church, and a free ſchool; beſides a charity ſchool for 80 boys and another for 20 girls. It has been very much reduced by fires; but is ſtill a very agreeable town, with rich meadow-ground, on the Foſſe, which runs here almoſt parallel with the river Soar. The new canal has made the coal-trade here very extenſive.

LOUGHBRICKLAND, a fair and poſt town of Ireland, ſituated in the county of Down, and province of Ulſter, 58 miles from Dublin. The name ſignifies the lake of the *ſpeckled trouts*; and it was ſo called from a lake near it, which abounds with thoſe fiſh. It conſiſts of one broad ſtreet, at the end of which is the pariſh-church, ſaid to have been built by Dr Taylor when biſhop of Dromore, ſoon after the Reſtoration. The linen manufacture is carried on here very extenſively; and the town is a great thoroughfare, the turnpike road from Dublin to Belfaſt paſſing through a red bog near it. The fairs are five in the year.

LOUGH-DERG, anciently *Derg-abhan*, i. e. "the river of the woody moraſs," from a river which iſſues out of this lake. This lough is ſituated in the county of Donegal and province of Ulſter in Ireland, and is famous for having in it the iſland that contains St Patrick's purgatory, which is a narrow little cell, hewn out of the ſolid rock, in which a man could ſcarce ſtand upright.—There is alſo a lake of this name ſituated between the counties of Galway and Tipperary.

LOUGH-NEACH, a loch or lake of Ireland, ſituated in the counties of Armagh, Down, Derry, and Antrim, and province of Ulſter. It is the largeſt in Europe, thoſe of Ladoga and Onega in Ruſſia, and that of Geneva in Switzerland, excepted; being 20 miles long and 15 broad. The area of this lake is computed to be 100,000 acres. It is remarkable for a healing virtue; and likewiſe for petrifying wood, which is not only found in the water but in the adjacent ſoil at a conſiderable depth. On its ſhores ſeveral beautiful gems have been diſcovered. Its ancient name was *Loch-eacha* or *Loch-Neach*, from *loch*, "a lake," and *Neach*, "wonderful, divine, or eminent." Its petrifying powers are not inſtantaneous, as ſeveral of the ancients have ſuppoſed, but require a long ſeries of ages to bring them to perfection, and appear to be occaſioned by a fine mud or ſand, which inſinuates itſelf into the pores of the wood, and which in proceſs of time becomes hard like ſtone. On the borders of this lake is Shane's caſtle, the elegant ſeat of the right honourable John O'Neil. Dr Smyth ſeems to doubt whether the healing quality in this lake is not to be confined to one ſide of it, called the *fiſhing-bank*; and he informs us, that this virtue was diſcovered in the reign of Charles II. in the inſtance of the ſon of one Mr Cunningham, who had an *evil* which run on him in eight or ten places; and notwithſtanding all applications ſeemed incurable, at length he was perfectly healed, after bathing in this lough about eight days. Hence that writer gives us another derivation of the name *Lochneach*, which (he ſays) ſeems to hint at this quality; *Neaſg* or *Neas*, in Iriſh, ſignifying a ſore or ulcer," which might not improbably be corrupted into *Neagh*: Hence he apprehends, this lake was remarked at a much earlier period for its healing property. As to its petrifying power, it is mentioned by Nenius, a writer of the 9th century, who ſays, "Eſt aliud ſtagnum quod facit ligna dureſcere in lapides. Homines autem findunt ligna, et poſt quam formaverunt, projiciunt in ſtagnum, et manent in eo uſque ad caput anni, et in capite anni lapis invenitur, et vocatur ſtagnum *Luch-Echach*." Lough-Neach gives title of baron to the family of *Skeffington*.

Lough-ſtrangford, Louis.

LOUGH-STRANGFORD, a lake of Ireland, ſituated in the county of Down and province of Ulſter. It takes its preſent name from a ſmall port-town called *Strangford*, ſeated on the weſt ſide of the narrow entrance into the ſea. It was formerly known by the name of *Lough-Cone* or *Lough-Coyne*. It is a deep bay or inlet of the ſea, about 17 miles long and four or five broad; it goes weſt as far as Downpatrick, and north as far as Comber and Newtown, and by computation covers 25,775 acres, Iriſh plantation meaſure. It abounds with excellent fiſh, particularly ſmelts; and off the bar there is a periodical herring fiſhery in or about Auguſt. The bar or entrance into this lough is about three miles below Strangford. There is a long rock at the entrance in the middle of the paſſage, dangerous to ſtrangers on account of the current; yet there is a broad paſſage on either ſide, and deep water. The current here is very ſtrong and rapid, running at the rate of ſix or ſeven miles an hour. There are but few veſſels that go higher up than Strangford. A good many veſſels bound up the channel put in here, if the wind is unfavourable to their paſſage. The iſlands in this lake are numerous; Doctor Boat enumerates them at 260. But from an actual ſurvey, made at the time Dr Smyth wrote his hiſtory of that county, it appears, there are 54 iſlands ſmall and great, known by particular names, and many others nameleſs; the contents of theſe 54 iſlands added together amount to 974 acres and an half. The great and profitable manufacture carried on in theſe iſlands, and the flat ſtony coaſts ſurrounding the lake, is the burning of ſea-weed into kelp, which employs a number of hands, and has been computed to produce to the ſeveral proprietors a neat profit of 1000 l. *per annum* and upwards. Four of the iſlands here are called *Swan iſlands*, from the number of ſwans that frequent them.

LOUIS, or *Knights of* St Louis, the name of a military order in France, inſtituted by Louis XIV. in 1693. Their colours are of a flame colour, and paſs from left to right; the king is their grand maſter. There are in it eight great croſſes, and 24 commanders; the number of knights is not limited. At the time of their inſtitution, the king charged his revenue with a fund of 300,000 livres for the penſions of the commanders and knights.

LOUIS, *Lewis*, *Louis d'or*, or *Lewidore*, a French coin, firſt ſtruck in 1640, under the reign of Louis XIII. and which has now a conſiderable currency. See MONEY-*Table*.

LOUISIANA,

Louiſiana || Louvain.

LOUISIANA, a country in North-America, bounded on the ſouth by the gulph of Mexico, on the eaſt by the river Miſſiſippi, on the weſt by New Mexico, and on the north by an unknown country. It extends from the 29th to the 40th degree of north latitude, and from about the 80th to the 96th or 97th degree weſt longitude from London. The climate of Louſiana varies according to the latitudes. The ſouthern parts are not ſo hot as thoſe parts of Africa which lie under the ſame parallel, and the northern parts are colder than the countries of Europe at the ſame diſtance from the pole: the cauſes of which are ſuppoſed to be the thick foreſts which over-run the country, and the great number of rivers; the former preventing the ſun from heating the earth, and the latter ſupplying it with moiſt vapours; beſides the cold winds which come from the north over vaſt tracts of land. They have bad weather; but it never laſts long, for the rain generally falls in ſtorms and ſudden ſhowers; the air is wholeſome, the inhabitants healthy, and they who are temperate live to a great old age. The country is extremely well watered; and almoſt all the rivers that run through it fall into the Miſſiſippi, which diſcharges itſelf into the gulph of Florida.

LOUSE, in zoology. See PEDICULUS and LICE.

LOUSY DISEASE. See MEDICINE-*Index*.

LOUTH, a town of Lincolnſhire in England, 156 miles from London. It is a town corporate; and one of the handſomeſt and gayeſt in the county, there being in it not only frequent aſſemblies, concerts, &c. but even maſquerades. Here are ſeveral handſome houſes. From hence there is a canal to the ſea at Tilney, about eight miles. Beſides a charity ſchool for 40 children, it has a free ſchool founded by Edward VI. with a large church, and a fine ſteeple, which ſome think is as high as Grantham ſpire, which is 288 feet high. Its markets are on Wedneſday and Saturday, and its fairs on May 24th, and Auguſt 16th.

LOUTH, a county in the eaſtern part of Ireland, which extends in the form of a bow or half-moon, on the ſide of the ocean, being much longer than it is broad; it is bounded on the ſouth and ſouth-weſt by the county of Eaſt-Meath, on the north-weſt by Monaghan, on the north by Armagh, and on the north-eaſt by the bay of Carlingford, which parts it from the county of Down: it is watered by ſeveral ſmall rivers which fall into the ſea; and its ſouth frontiers are watered by the river Boyne. Its chief towns are Dundalk and Carlinford; unleſs we include Drogheda, a part whereof is in this county. It is the ſmalleſt county in the kingdom; but very fertile and pleaſant, and abounding with many remains of antiquities, of which Mr Wright, in his Louthiana, has given a very ample deſcription. It contains 111,180 Iriſh plantation acres, 50 pariſhes, 5 baronies, and 5 boroughs, and returns 10 members to parliament: it is about 22 miles long and 14 broad.

LOUTH, a town in the above county, having a yearly fair.

LOUVAIN, a city in the Auſtrian Netherlands, in the province of Brabant, pleaſantly ſeated on the river Dyle, in a plentiful and agreeable country. The walls are about eight or nine miles in circumference; but they include ſeveral fields and vineyards. The caſtle ſtands on a high hill, ſurrounded with fine gardens, and has a charming proſpect all over the country: This town contains nine market places, 14 water-mills, 126 ſtreets, 16 ſtone bridges, and ſeveral handſome palaces. The town-houſe is a venerable old building, adorned with ſtatues on the outſide; and the churches are very handſome, particularly the collegiate church of St Peter, but the principal ornament is the univerſity, founded only in 1426 by John IV. duke of Brabant, with the concurrence of Pope Martin V. It contains about 40 colleges, four of which are called *Pedagogia*. There is in the number alſo an Engliſh college of friars-preachers, which owes its eſtabliſhment to the liberalities of Cardinal Philip Howard, brother to the duke of Norfolk, who, before he was raiſed to the purple, had been private chaplain to Queen Catherine, conſort to Charles II. The Iriſh have likewiſe a ſeminary, erected in part under the care of Eugenius Mattheus, titular archbiſhop of Dublin, anno 1623, which receives its appointments from the Propaganda at Rome. Beſides the above, there are two convents for the Iriſh, one of Recollects and the other of Dominicians, where divinity and the Matheſis are taught. In the laſt century the number of ſcholars exceeded 4000, but in the year 1743 the inhabitants amounted to 12,000, including 2000 ſtudents only.—At the beginning of the 14th century, under John III. it flouriſhed conſiderably in the manufacture of woollen cloth: 400 houſes were then occupied by ſubſtantial clothiers, who gave employment to an incredible number of weavers, ſo great it is ſaid, that a bell was rung to prevent any injuries which the children in the ſtreet might receive from the crowd and hurry on their returning from work. In 1382, theſe weavers, however, took up arms, and rebelled againſt their ſovereign Prince Wenceſlaus, throwing from the windows of the Town-hall 17 of the aldermen and counſellors, and afterwards proceeded to lay waſte great part of Brabant: but being beſieged and reduced to great extremities, they ſubmiſſively implored his clemency: which was granted after the execution of ſome of the principal ringleaders. The weavers, the chief inſtigators to this revolt, were baniſhed, the greater part of whom took refuge in England; where they firſt introduced, or at leaſt augmented very much, the woollen manufacture. The town, by this circumſtance, being almoſt depopulated, the univerſity was eſtabliſhed to ſupply in ſome meaſure the loſs of the rebellious clothiers. Since that time the manufacture gradually declined, no cloth of any account being made there at preſent. This impolitic ſtep of the Duke Wenceſlaus ſent treaſures to England, through the hands of thoſe exiled people; an important leſſon to governors, that they ſhould deal with great precaution reſpecting ſuch uſeful members of the community. Upon the ruins of theſe looms was formed the cloth manufacture of Limbourg, which is carried on with good advantage to this day. There is yet ſtanding at Louvain part of the old drapers-hall, now converted into four public ſchools, where lectures in divinity, philoſophy, law, and phyſic, are given, and the public acts are made. Adjoining to the ſchools is the univerſity library, which altogether compoſe a large pile of building. Over the door of the chief entrance we read theſe words, *Sapientia ædificavit ſibi domum*. The principal church is collegiate, dedicated to

Louvain.

Louys, Low-bell

St Peter, which had formerly three very large towers with elevated ſpires, one conſiderably higher than the two collaterals; theſe were blown down in the year recorded by this chronogram, *oMnIa CaDVnt*. From the name of this church the burghers have acquired the nick-name of *Petermen*, whoſe anceſtors having clothed the back by a noble woollen manufacture, the modern Petermen now compoſe an ignoble mixture for the belly, called after them, *Peterman beer*, a ſort of whitiſh muddy ale, which they notwithſtanding ſend in large quantities to all parts of the country, as well as to Holland, by the canals. Louvain was anciently the capital of the province, long before Bruxelles had any claim to that title. E. Long. 4. 40. N. Lat. 51. 12.

LOUYS, or Louis, (John), an engraver of conſiderable eminence, who flouriſhed about the middle of the 16th century. According to Baſan, he was a native of Flanders. He learned the art of engraving from Peter Soutman, at the time that Suyderhoef ſtudied under the ſame maſter; and his uſual ſtyle of engraving bears ſome reſemblance to that of his maſter's. One of his beſt prints is, Diana, with her nymphs, repoſing after the chaſe; a middling-ſized plate, lengthwiſe, from Rubens.

LOW-bell, in birding, a name given to a bell, by means of which they take birds in the night, in open champaign countries, and among ſtubble, in October. The method is to go out about nine o'clock at night in a ſtill evening, when the air is mild and the ſun does not ſhine. The low-bell ſhould be of a deep and hollow ſound, and of ſuch a ſize that a man may conveniently carry it in one hand. The perſon who carries it is to make it toll all the way he goes, as nearly as may be, in that manner in which the bell on the neck of a ſheep tolls as it goes on and feeds. There muſt alſo be a box made like a large lanthorn, about a foot ſquare, and lined with tin, but with one ſide open. Two or three great lights are to be ſet in this; and the box is to be fixed to the perſon's breaſt, with the open ſide forwards, ſo that the light may be caſt forward to a great diſtance. It will ſpread as it goes out of the box; and will diſtinctly ſhow to the perſon that carries it whatever there is in the large ſpace of ground over which it extends, and conſequently all the birds that rooſt upon the ground. Two perſons muſt follow him who carries the box and bell, one on each ſide, ſo as not to be within the reach of the light to ſhow themſelves. Each of theſe is to have a hand-net of about three or four feet ſquare, faſtened to a long ſtick or pole; and on whichever ſide any bird is ſeen at rooſt, the perſon who is neareſt is to lay his net over it, and take it with as little noiſe as poſſible. When the net is over the bird, the perſon who laid it is not to be in a hurry to take the bird, but muſt ſtay till he who carries the light is got beyond it, that the motions may not be diſcovered. The blaze of the light and the noiſe of the bell terrify and amaze the birds in ſuch a manner that they remain ſtill to be taken; but the people who are about the work muſt keep the greateſt quiet and ſtillneſs that may be.

Some people are fond of going on this ſcheme alone. The perſon then fixes the light box to his breaſt and carries the bell in one hand and the net in the other; the net in this caſe may be ſomewhat ſmaller, and the handle ſhorter. When more than one are out at a time, it is always proper to carry a gun; as it is no uncommon thing to ſpy a hare when on this expedition.

Low ‖ Lowering.

LOW (East), a town of Cornwall in England, 231 miles from London, in the poſt-road from Plymouth. It is an ancient borough by preſcription, made a corporation by charter of queen Eliſabeth, conſiſting of nine burgeſſes (one of whom is yearly choſen the mayor), a recorder, aldermen, &c.; and the mayor, magiſtrates, and freemen, who are about 68, chooſe the members of parliament. This being a manor of the duchy of Cornwall, was ſettled by king William on lord Somers, and is now held by the corporation at the fee-farm rent of 20s. a-year. It is ſeated pretty commodiouſly on a creek of the ſea, over which there is a large ſtone bridge, ſupported by 15 arches, which leads to *Weſt Low*, ſtanding between two hills. The chief benefit which the inhabitants have is in their fiſhery. Here is a battery of four guns, and a ſmall chapel. Its market is on Saturday, and it has two fairs in the year.

Low (Weſt), called alſo *Port-Pigham*, a town of Cornwall, divided from Eaſt Low by a ſtone bridge of 15 arches over the river Low, from whence both towns receive their name, as the river does from the lowneſs of its current between its high banks. The corporation, by charter of queen Eliſabeth, conſiſts of 12 burgeſſes, one of whom is annually choſen mayor, and, with the other burgeſſes, has power to chooſe a ſteward. Its members, whom it has ſent to parliament ever ſince the 6th of Edward VI. are elected by the corporation and freemen, who are about 60. There was a chapel of eaſe here in the reign of Henry VIII. which was afterwards converted into a town-hall; and the town lying in the pariſh of Talland, the people go thither to church. The market is on Saturday, and fair on April 25. There is a pretty little harbour here; near the mouth of which is a ſmall iſland called St George's, which abounds with ſea-pies. The river here is navigable for veſſels of 100 tons.

LOWER (Richard), an eminent Engliſh phyſician in the 17th century, was born in Cornwall, and educated at Weſtminſter-ſchool and Oxford. He entered on the phyſic line; and practiſed under Dr Thomas Willis, whom he inſtructed in ſome parts of anatomy, eſpecially when the latter was writing his *Cerebri anatome*. He, with Dr Willis, in 1674, diſcovered the medicinal waters at Aſhop in Northamptonſhire; which, upon their recommendations, became very much frequented. In 1666 he followed Dr Willis to London; practiſed phyſic under him; and became fellow of the royal ſociety, and of the college of phyſicians. In 1669 he publiſhed his *Tractatus de corde*; and, after the death of Dr Willis in 1675, he was eſteemed the moſt eminent phyſician in London. Upon the breaking out of the Popiſh plot in 1678, ſays Mr Wood in his *Athenæ Oxonienſis*, he cloſed with the Whigs, ſuppoſing that party would carry all before them; but, being miſtaken, he loſt his credit and practice. He died in 1691.

LOWERING, among diſtillers, a term uſed to expreſs the debaſing the ſtrength of any ſpirituous liquor, by mixing water with it. The ſtandard and marketable price of theſe liquors is fixed in regard to

Lowth. a certain ſtrength in them called *proof*; this is that ſtrength which makes them, when ſhaken in a phial or poured from on high into a glaſs, retain a froth or crown of bubbles for ſome time. In this ſtate, ſpirits conſiſt of about half pure or totally inflammable ſpirit, and half water; and if any foreign or home ſpirits are to be expoſed to ſale, and are found to have that proof wanting, ſcarce any body will buy it till it has been diſtilled again and brought to that ſtrength; and if it is above that ſtrength, the proprietor uſually adds water to it to bring it down to that ſtandard. See the article PROOF.

There is another kind of lowering among the retailers of ſpirituous liquors to the vulgar, by reducing it under the ſtandard proof. Whoever has the art of doing this without deſtroying the bubble proof, which is eaſily done by means of ſome addition that gives a greater tenacity to the parts of the ſpirits, will deceive all that judge by this proof alone. In this caſe, the beſt way to judge of liquors is by the eye and tongue, and eſpecially by the inſtrument called HYDROMETER.

LOWTH (William), D.D. a learned divine, born at London in 1661, was the ſon of an apothecary, and took his degrees at Oxford. His eminent worth and learning recommended him to Dr Mew biſhop of Wincheſter, who made him his chaplain, gave him two livings in Hampſhire, and conferred on him a prebend in the cathedral of Wincheſter. He acquired an unuſual ſhare of critical learning. Thus ſituated in life, the labours of Mr Lowth appear to have been ſtrictly confined within the limits of his own province, and applied ſolely to the peculiar duties of his function: yet, in order that he might acquit himſelf the better in theology, he had purſued his ſtudies with a more general and extenſive view. Few were more deeply verſed in critical learning; there being ſcarcely any ancient author, Greek or Latin, profane or eccleſiaſtical, eſpecially the latter, but what he had read with accuracy, conſtantly accompanying his reading with critical and philological remarks. Of his collections in this way he was upon all occaſions very communicative. Hence his notes on *Clemens Alexandrinus*, which are to be met with in Potter's edition of that father. Hence his remarks on *Joſephus*, communicated to Hudſon for his edition, and acknowledged in the preface: as alſo thoſe larger and more numerous annotations on the Eccleſiaſtical Hiſtorians, inſerted in *Reading's* edition of them at Cambridge. The author of *Bibliotheca Biblica* was indebted to him for the ſame kind of aſſiſtance. Chandler, late biſhop of Durham, while engaged in his "Defence of Chriſtianity, from the Prophecies of the Old Teſtament, againſt the Diſcourſe of the Grounds and Reaſons of the Chriſtian Religion," and in his "Vindication of the Defence, in anſwer to The Scheme of Literal Propheey conſidered," held a conſtant correſpondence with him, and conſulted him upon many difficulties that occurred in the courſe of that work. The moſt valuable part of his character was that which leaſt appeared in the eyes of the world, the private and retired part, that of the good Chriſtian and the uſeful pariſh-prieſt. His piety, his diligence, his hoſpitality and beneficence, rendered his life highly exemplary, and greatly enforced his public exhortations. He married Margaret, daughter of Robert Pitt, Eſq; of Blandford, by whom he had two ſons and three daughters. (ſee the next article). He died in 1732, and was buried by his own orders in the church-yard at Buriton. He publiſhed, 1. A vindication of the divine authority and inſpiration of the Old and New Teſtaments; 2. Directions for the profitable reading of the Holy Scripture; 3. Commentaries on the prophets; and other works. Lowth.

LOWTH (Robert), D.D. ſecond ſon of the preceding Dr William Lowth, and biſhop ſucceſſively of St David's, Oxford, and London, was born on the 29th of November 1710, probably at Buriton in the county of Hants. He received the rudiments of his education in Wincheſter college, where his ſchool exerciſes were diſtinguiſhed by uncommon elegance; and having reſided the requiſite number of years in that ſeminary, in 1730 he ſucceeded on the foundation at New College, Oxford. He took the degree of M. A. June 8. 1737. Though his abilities muſt have been known to thoſe with whom he was connected, he was not forward to appear before the world as a writer. At Oxford he continued many years improving his talents, with little notice from the great, and with preferment ſo ſmall as to have at preſent eſcaped the diſtinct recollection of ſome of his contemporaries.

He was not, however, ſuffered to languiſh for ever in obſcurity. His genius and his learning forced themſelves upon the notice of the illuſtrious ſociety of which he was a member; and he was placed in a ſtation where he was eminently qualified to ſhine. In 1741 he was elected by the univerſity to the profeſſorſhip of poetry, re-elected in 1743, and whilſt he held that office he read his admirable lectures *De ſacra poeſi Hebræorum*. In 1744 biſhop Hoadley collated him to the rectory of Ovington in the county of Hants; added to it, nine years afterwards, the rectory of Eaſt Weedhay in the ſame county; and in the interim raiſed him to the dignity of archdeacon of Wincheſter. Theſe repeated favours he ſome years afterwards acknowledged in the following manly and reſpectful terms of gratitude: "This addreſs, My Lord, is not more neceſſary on account of the ſubject, than it is in reſpect of the author. Your Lordſhip, unſolicited and unaſked, called him from one of thoſe colleges to a ſtation of the firſt dignity in your dioceſe, and took the earlieſt opportunity of accumulating your favour upon him, and of adding to that dignity a ſuitable ſupport. Theſe obligations he is now the more ready thus publicly to acknowledge, as he is removed out of the reach of further favours of the like kind. And though he hath relinquiſhed the advantages ſo generouſly conferred on him, yet he ſhall always eſteem himſelf highly honoured in having once enjoyed the patronage of the great advocate of civil and religious liberty." Lowth.

On the 8th of July 1754 the univerſity of Oxford conferred upon him the degree of D. D. by diploma; an honour which, as it is never granted but to diſtinguiſhed merit, was probably conferred on Mr Lowth in conſequence of his prelections on the Hebrew poetry, which had then been lately publiſhed. Having in 1749 travelled with Lord George and Lord Frederick Cavendiſh, he had a claim upon the patronage of the

Lowth. Devonſhire family; and in 1755, the late duke being then lord lieutenant of Ireland, Dr Lowth went to that kingdom as his grace's firſt chaplain. Soon after this appointment he was offered the biſhopric of Limerick; but preferring a leſs dignified ſtation in his own country, he exchanged it with Dr Leſlie, prebendary of Durham and rector of Sedgefield, for theſe preferments. In November 1765 he was choſen F.R.S. In June 1766 he was, on the death of Dr Squire, preferred to the biſhopric of St David's; which, in the October following, he reſigned for that of Oxford, vacant by the tranſlation of biſhop Hume to Saliſbury. In April 1777, he was tranſlated to the ſee of London, vacant by the death of biſhop Terrick; and in 1783 he declined the offer of the primacy of all England.

Having been long afflicted with the ſtone, and having long borne the ſevereſt ſufferings of pain and ſickneſs with the moſt exemplary fortitude and reſignation, this great and good man died at Fulham, Nov. 3. 1787; and on the 12th his remains were privately interred in a vault at Fulham church, near thoſe of his predeceſſor. He had married in 1752, Mary, the daughter of Laurence Jackſon of Chriſt-church, Hants, Eſq; by whom he had two ſons and five daughters. His lady and two children only ſurvived him.

His literary character may be eſtimated from the value and the importance of his works; in the account of which we may begin with his *Prelections on the Hebrew Poetry*. The choice of ſo intereſting a ſubject naturally attracted general attention; and the work has been read with equal applauſe abroad and at home. In theſe prelections the author has acquitted himſelf in the moſt maſterly manner, as a poet, a critic, and a divine; and ſuch is the claſſic purity of his Latin ſtyle, that though we have read the work with the cloſeſt attention, and with no other view than to diſcover, if poſſible, an Angliciſm in the compoſition, we never found a ſingle phraſe to which, we believe, a critic of the Auguſtan age could poſſibly have objected. This is an excellence to which neither Milton nor Johnſon has attained; to which indeed no other Engliſh writer of Latin with whom we are acquainted has attained, unleſs perhaps Atterbury muſt be excepted. To the prelections was ſubjoined a ſhort confutation of biſhop Hare's ſyſtem of Hebrew metre; which occaſioned a Latin letter from Dr Edwards of Clare-hall, Cambridge, to Dr Lowth, in vindication of the Harian metre. To this the author of the prelections replied in a *larger confutation*, in which biſhop Hare's ſyſtem is completely overthrown, and the fallacy upon which it was built accurately inveſtigated. After much attentive conſideration, biſhop Lowth has pronounced the metre of the Hebrew to be perfectly irrecoverable.

In 1758 he publiſhed *The life of William of Wykeham, biſhop of Wincheſter*, with a dedication to Biſhop Hoadley; which involved him in a diſpute concerning a deciſion which that biſhop had lately made reſpecting the wardenſhip of Winchester-college. This controverſy was on both ſides carried on with ſuch abilities, that, though relating to a private concern, it may yet be read, if not with pleaſure at leaſt with improvement. The life of Wykeham is drawn from the moſt authentic ſources; and affords much information concerning the manners, and ſome of the public tranſactions of the period in which Wykeham lived, whilſt it diſplays ſome private intelligence reſpecting the two literary ſocieties of which he was the founder. In theſe two ſocieties Dr Lowth was educated, and he gratefully expreſſes his obligations to them. Lowth.

In 1762 was firſt publiſhed his *Short Introduction to Engliſh Grammar*, which has ſince gone through many editions. It was originally deſigned only for private and domeſtic uſe: but its judicious remarks being too valuable to be confined to a few, the book was given to the world; and the excellence of its method, which teaches what is right by ſhowing what is wrong, has inſured public approbation and very general uſe. In 1765 Dr Lowth was engaged with Biſhop Warburton in a controverſy, which made much noiſe at the time, which attracted the notice even of royalty, and of which the memory is ſtill recent. If we do not wiſh to dwell on the particulars of this controverſy, it is becauſe violent literary contention is an evil, which, though like other war it may ſometimes be unavoidable, is yet always to be regretted; and becauſe the characters of learned, ingenious, and amiable men, never appear to leſs advantage than under the form which that ſtate of hoſtility obliges them to aſſume. The two combatants indeed engaged with erudition and ingenuity ſuch as is ſeldom brought into conflict; but it appears that, in the opinion of Dr Johnſon, Warburton had the moſt ſcholaſtic learning, and that Lowth was the moſt correct ſcholar; that, in their conteſt with each other, neither of them had much argument, and that both were extremely abuſive. We have heard, and we hope it is true, that they were afterwards reconciled, and expreſſed mutual regret for the violence of their paſt conduct.

In 1778 Biſhop Lowth publiſhed his laſt great work, *A Tranſlation of Iſaiah*. To his literary and theological abilities, the tranſlator joined the moſt critical knowledge of the character and ſpirit of the eaſtern poetry; and, accordingly, the prophecies of Iſaiah (which, though almoſt always ſublime or elegant, are yet ſometimes obſcure) were tranſlated in a manner adequate to the higheſt expectations of the public. Several occaſional diſcourſes, which the Biſhop, by his ſtation, was at different times called upon to deliver, were of courſe publiſhed, and are all worthy of their excellent author; but there is one on the *kingdom of God*, on the extenſion and progreſſive improvement of Chriſt's religion, and on the means of promoting theſe by the advancement of religious knowledge, by freedom of inquiry, by toleration, and mutual charity, which may be diſtinguiſhed above the reſt, as exhibiting a moſt comprehenſive view of the ſucceſſive ſtates of the Chriſtian church, and containing the trueſt principles of Chriſtianity.

Of the Biſhop's poetical pieces, none diſplay greater merit than *Verſes on the Genealogy of Chriſt*, and *the Choice of Hercules*, both written very early in his life. He wrote a ſpirited *Imitation of an Ode of Horace*, applied to the alarming ſituation of this country in 1745; and likewiſe ſome *verſes on the death of Frederic prince of Wales*, with a few ſmaller poems. The following inſcription on the tomb of his daughter, beautifully diſplays his paternal affection and claſſic taſte. As it is ſhort, and, in our opinion, has all the merit

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merit of the ancient epitaph, the reader will probably be pleaſed with ſuch a ſpecimen of his lordſhip's Latinity.

Cara, vale, ingenio præſtans, pietate, pudore,
Et pluſquam natæ nomine cara, vale.
Cara Maria, vale. At veniet felicius ævum,
Quando iterum tecum, ſim modo dignus, eo.
Cara, redi, læta tum dicam voce, paternas,
Eja, age in amplexus, cara Maria, redi.

Learning and taſte, however, did not conſtitute Biſhop Lowth's higheſt excellence. Eulogium itſelf can ſcarcely aſcend to extravagance when ſpeaking of him either as a private man or as a paſtor of the church of Chriſt. His amiable manners rendered him an ornament to his high ſtation, whilſt they endeared him to all with whom he converſed; and his zeal for the intereſts of true religion made him eager to promote to places of truſt and dignity ſuch clergymen as he knew were beſt qualified to fill them. Of his modeſty, gentleneſs, and pleaſing converſation, we have the teſtimony of one whoſe deciſion will hardly be diſputed.—"It would anſwer no end (ſays Biſhop Warburton) to tell you what I thought of the author of Hebrew poetry, before I ſaw him. But this I may ſay, I was never more ſurpriſed, when I did ſee him, than to find him of ſuch amiable and gentle manners, of ſo modeſt, ſenſible, and diſengaged a deportment." He united, indeed, in an eminent degree, the qualities of the gentleman with thoſe of the ſcholar: he converſed with elegance, as he wrote with accuracy. As a huſband, a father, or the maſter of a family, he was as nearly faultleſs as the imperfections of humanity will eaſily permit. His temper, when rouſed by what he thought improper conduct, was indeed ſuſceptible of conſiderable warmth; but if he could be highly offended, upon a ſlight conceſſion he could likewiſe forgive. His heart was tender and ſympathetic. He poſſeſſed a mind which felt its own ſtrength, and decided on whatever came before it with promptitude and firmneſs. In thoſe trials where affliction was to be ſuffered or ſubdued, he behaved as a man and a Chriſtian. His piety had no tincture of moroſeneſs; his charity no leaven of oſtentation. To his whole dioceſe he was endeared by his laudable diſcretion and his uſeful zeal. To the world he was a benefit by his examplary life and his ſplendid abilities. And whilſt virtue and learning are reverenced among men, the memory of LOWTH will be reſpected and admired.

LOXIA, in zoology; the name of a genus of birds of the order of paſſeres, the diſtinguiſhing characters of which are theſe: The bill is ſtrong, convex above and below, and very thick at the baſe: the noſtrils are ſmall and round: the tongue is as if cut off at the end: the toes are four, placed three before and one behind; excepting in one ſpecies, which has only two toes before and one behind.

1. The curviroſtra, or common croſs-bill, which is about the ſize of a lark, is known by the ſingularity of its bill, both mandibles of which curve oppoſite ways and croſs each other: The general colour of the plumage in the male is of a red-lead inclining to roſe-colour, and more or leſs mixed with brown: the wings and tail are brown; the legs black. The female is of a green colour, more or leſs mixed with brown in thoſe parts where the male is red. This ſpecies is a conſtant inhabitant of Sweden, Germany, Poland, Switzerland, Ruſſia, and Siberia, where it breeds; but migrates ſometimes in vaſt flocks into other countries, as is now and then the caſe in reſpect to England; for though in ſome years a few are met with, yet in others it has been known to viſit us by thouſands, fixing on ſuch ſpots as are planted with pines, for the ſake of the ſeeds, which are its natural food: it is obſerved to hold the cone in one claw like the parrot, and to have all the actions of that bird when kept in a cage. It is alſo found in North America and Greenland; and is ſaid to make the neſt in the higheſt parts of the fir-trees, faſtening it to the branch with the reſinous matter which exſudes from the trees. Loxia.

2. The coccothrauſtes, or hawfinch, is in length ſeven inches; breadth, 13: the bill is funnel-ſhaped, ſtrong, thick, and of a dull pale pink colour; the breaſt and whole under ſide are of a dirty fleſh colour; the neck aſh-coloured; the back and coverts of the wings of a deep brown, thoſe of the tail of a yellowiſh bay: the greater quill-feathers are black, marked with white on their inner webs: the tail is ſhort, ſpotted with white on the inner ſides; and the legs are of a fleſh-colour. This ſpecies is ranked among the Britiſh birds; but only viſits theſe kingdoms occaſionally, and for the moſt part in winter, and never known to breed here. It is more plenty in France, coming into Burgundy in ſmall flocks, about the beginning of April; and ſoon after making the neſt, which is placed between the bifurcation of the branches of trees, about twelve feet from the ground: it is compoſed of ſmall dry fibres, intermixed with liverwort, and lined with finer materials. The eggs are of a roundiſh ſhape, of a bluiſh green ſpotted with olive brown, with a few irregular black markings interſperſed. It is alſo common in Italy, Germany, Sweden, and the weſt and ſouthern parts of Ruſſia, where the wild fruits grow. It feeds on berries, kernels, &c. and from the great ſtrength of the bill, it cracks the ſtones of the fruit of the haws, cherries, &c. the greateſt with eaſe.

3. The enucleator, or pine-groſsbeak, is nine inches in length, and weighs two ounces. The bill is ſtrong, duſky, and forked at the end: the head, back, neck, and breaſt, are of a rich crimſon; the bottoms of the feathers aſh-colour; the quill-feathers and tail duſky, their exterior edges of a dirty white: the legs are black. This ſpecies frequents the moſt northern parts of this kingdom, being only met with in Scotland, and eſpecially the Highlands, where it breeds, and inhabits the pine-foreſts, feeding on the ſeeds, like the croſs-bill. It is alſo found in all the pine-foreſts of Siberia, Lapland, and the northern parts of Ruſſia: it is common about St Peterſburgh in autumn, and is caught in great plenty at that time for the uſe of the table; returning north in ſpring. They are likewiſe common to the northern parts of America; appearing at Hudſon's Bay in May, to which place they are ſaid to come from the ſouth, and are obſerved to feed on the buds of willow. The ſouthern ſettlements are inhabited by them throughout the year, but the northern only in the ſummer ſeaſon. Our laſt voyagers met with this bird in Norton Sound; it was alſo found at Aoonalaſhka.

4. The pyrrhula, or bullfinch, is ſo generally known

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as almoſt to ſuperſede deſcription: The head, wings, and tail, are black; the breaſt and belly red; the upper tail coverts and vent white; and the breaſt aſh-colour. The female differs in having the under parts of a reddiſh brown. This ſpecies is common in moſt parts of the continent of Europe, and throughout Ruſſia and Siberia, at which laſt places it is caught for the table. It is pretty common in England; and builds in the buſhes, five or ſix feet from the ground. The neſt is compoſed chiefly of moſs; and the eggs, which are five or ſix in number, are dirty bluiſh white, marked at the large end with dark ſpots. The time of breeding is about the end of May or beginning of June. In the ſummer it moſtly frequents woods and the more retired places. In winter it approaches gardens and orchards, and has been generally ſtigmatiſed for making havock among the buds of trees. From ſome late obſervations, however, it would appear, that the object of theſe birds is not the bud, but "the *worm* in the bud;" and that this ſpecies, in conjunction with various other ſpecies of ſmall birds, are the frequent means of defending the embryo-fruits, and thence promoting their growth to maturity: for the warmth that ſwells the buds, not only hatches nidos (eggs) of unnumbered tribes of inſects, whoſe parent flies, by an unerring inſtinct, laid them there,—but brings forward a numerous race already in a caterpillar ſtate, that now iſſue from their concealments, and make their excurſion along the budding branches, and would probably deſtroy every hope of fruitage, but for thoſe uſeful inſtruments for its preſervation, whoſe young are principally fed by eating caterpillars.—The bullfinch, in its wild ſtate, has only a plain note; but when tamed it becomes remarkably docile, and may be taught any tune after a pipe, or to whiſtle any notes in the juſteſt manner: it ſeldom forgets what it has learned; and will become ſo tame as to come at call, perch on its maſter's ſhoulders, and (at command) go through a difficult muſical leſſon. They may be alſo taught to ſpeak, and ſome thus inſtructed are annually brought to London from Germany.

5. The cœrulea, or blue groſsbeak, is the ſize of the bullfinch: The bill is ſtout, brown, and the baſe of it ſurrounded with black feathers which reach on each ſide as far as the eye: the whole plumage beſides is of a deep blue, except the quills and tail, which are brown, with a mixture of green, and acroſs the wing coverts a band of red: the legs are duſky. It is an inhabitant of South America; but is ſometimes found in Carolina, where it is a very ſolitary bird, and ſeen only in pairs, but diſappear in winter. It has only a ſingle note.

6. The violàcea, or purple groſsbeak, is about the ſize of a ſparrow: The bill is black: the plumage, violet black; except the irides, a ſtreak over the eye, the chin, and the vent, which are red: the legs are duſky grey. This ſpecies inhabits the Bahama Iſlands, Jamaica, and the warmer parts of America.

7. The cardinalis, or cardinal groſsbeak, is near eight inches in length. The bill is ſtout, and of a pale red colour: the irides are hazel: the head is greatly creſted, the feathers riſing up to a point when erect: round the bill, and on the throat, the colour is black; the reſt of the bird of a fine red; the quills and tail duller than the reſt, and browniſh within: the legs are the colour of the bill. The female differs from the male, being moſtly of a reddiſh brown. This ſpecies is met with in ſeveral parts of North America; and has attained the name of nightingale from the fineneſs of its ſong, the note of which reſembles that of the nightingale. In ſpring, and moſt part of the ſummer, it ſits on the tops of the higheſt trees, ſinging early in the morning, and piercing the ear with its loud pipe. Theſe birds are frequently kept in cages, in which they ſing throughout the year, with only ſhort intervals of muteneſs. They are fond of *maize* and *buck-wheat*; and will get together great hoards of theſe, often as much as a buſhel, which they artfully cover with leaves and ſmall twigs, leaving only a ſmall hole for entrance into the magazine. They are alſo fond of *bees*. They come the beginning of April into New York and the Jerſeys, and frequent the Magnolia ſwamps during the ſummer: in autumn they depart towards Carolina. They are pretty tame, frequently hopping along the road before the traveller; but are not gregarious, ſcarce ever more than three or four being met with together. From their being familiar birds, attempts have been made to breed them in cages, but without ſucceſs.

8. The orix, or grenadier groſsbeak, is about the ſize of a houſe-ſparrow. The forehead, ſides of the head, and chin, are black; the breaſt and belly the ſame: the wings are brown, with pale edges; and the reſt of the body of a beautiful red colour: the legs are pale. Theſe birds are inhabitants of Saint Helena; they are alſo in plenty at the Cape of Good Hope, where they frequent watery places that abound with reeds, among which they are ſuppoſed to make their neſt. If (as is ſuppoſed) this be the ſame with Kolben's Finch, he ſays that the neſt is of a peculiar contrivance, made with ſmall twigs, interwoven very cloſely and tightly with cotton, and divided into two apartments with but one entrance (the upper for the male, the lower for the female), and is ſo tight as not to be penetrated by any weather. He adds, that the bird is ſcarlet only in ſummer, being in the winter wholly aſh-coloured. Theſe birds, ſeen among the green reeds, are ſaid to have a wonderful effect; for, from the brightneſs of their colours, they appear like ſo many *ſcarlet lilies*.

9. The Philippina, or Philippine groſsbeak, is about the ſize of a ſparrow: the top of the head, the hind part of the neck and back, and the ſcapulars, are yellow, the middle of the feathers brown: the lower part of the back is brown, with whitiſh margins: the fore part of the neck and breaſt are yellow; and from thence to the vent yellowiſh white; the wing-coverts brown, edged with white: the quills are brown, with pale rufous or whitiſh edges; and the tail the ſame: the legs are yellowiſh. Theſe birds inhabit the Philippine Iſlands; and are noted for making a moſt curious neſt, in form of a long cylinder, ſwelling out into a globoſe form in the middle. This is compoſed of the fine fibres of leaves, &c. and faſtened by the upper part to the extreme branch of a tree. The entrance is from beneath; and, after aſcending the cylinder as far as the globular cavity, the true neſt is placed on one ſide of it; where this little architect

lays

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lays her eggs, and hatches her brood in perfect ſecurity.

A variety of this ſpecies, the *Baglafechat* (Buff. iii. 469), an inhabitant of Abyſſinia, makes a very curious neſt like the former, but a little different in ſhape; and is ſaid to have ſomewhat of a ſpiral form, not unlike that of a nautilus. It ſuſpends it, like the other, on the extreme twig of ſome tree, chiefly one that hangs over ſome ſtill-water; and always turns the opening towards that quarter from whence leaſt rain may be expected.

10. The Abyſſinica, or Abyſſinian groſsbeak, is about the ſize of the hawfinch: the bill is black: the irides are red: the top and ſides of the head, throat, and breaſt, are black: the upper parts of the body, belly, and thighs, pale yellow, inclining to brown where the two colours divide: the ſcapulars are blackiſh; the wing-coverts brown, bordered with grey; the quills and tail brown, edged with yellow: the legs are of a reddiſh grey. This bird is found in Abyſſinia; and makes a curious neſt of a pyramidal ſhape, which is ſuſpended from the ends of branches like the others. The opening is on one ſide, facing the eaſt: the cavity is ſeparated in the middle by a partition; up which the bird riſes perpendicularly about half-way, when deſcending, the neſt is within the cavity on one ſide. By this means the brood is defended from ſnakes, ſquirrels, monkeys, and other miſchievous animals, beſides being ſecure from rain, which in that country ſometimes laſts for ſix months together.

11. The penſilis, or penſile groſsbeak, (the *Toddy-bird* of Fryer), is about the ſize of the houſe-ſparrow: the bill is black: the irides are yellow: the head, throat, and fore part of the neck, the ſame: from the noſtrils ſprings a dull green ſtripe, which paſſes through the eye and beyond it, where it is broader: the hind part of the head and neck, the back, rump, and wing-coverts, are of the ſame colour: the quills are black, edged with green; the belly is deep grey, and the vent of a rufous red: the tail and legs are black. This ſpecies is found at Madagaſcar; and fabricates a neſt of a curious conſtruction, compoſed of ſtraw and reeds interwoven in ſhape of a bag, the opening beneath. It is faſtened above to a twig of ſome tree; moſtly to thoſe growing on the borders of ſtreams. On one ſide of this, within, is the true neſt. The bird does not form a new neſt every year, but faſtens a new one to the end of the laſt; and often as far as five in number, one hanging from another. Theſe build in ſociety, like rooks; often five or ſix hundred being ſeen on one tree. They have three young at each hatch.

† *Japan*, p. 35.

Kæmpfer † mentions a bird ſimilar to this, if not the ſame, which makes the neſt, near Siam, on a tree with narrow leaves and ſpreading branches, the ſize of an apple-tree: the neſt in the ſhape of a purſe with a long neck, made of dry graſs and other materials, and ſuſpended at the ends of the branches; the opening always to the north-weſt. He counted fifty on one tree only; and deſcribes the bird itſelf as being like a Canary-bird, of a dark yellow, and chirps like a ſparrow.

‡ *Account of India and Perſia*, p. 76.

Fryer ‡ alſo talks of the ingenuity of the *Toddy Bird*, making a neſt "like a ſteeple, with winding meanders," and tying it by a ſlender thread to the bough of a tree. "Hundreds of theſe pendulous neſts may be ſeen on theſe trees." Loxia.

12. The chloris, or greenfinch, is a well-known bird: the general colour is a yellowiſh green, paleſt on the rump and breaſt, and inclining to white on the belly; the quills are edged with yellow, and the four outer tail-feathers are yellow from the middle to the baſe; the bill is pale-brown, and ſtout; and the legs are of a fleſh-colour.—This ſpecies is pretty common in Britain, and flies in troops during the winter. It makes the neſt in ſome low buſh or hedge, compoſed of dry graſs, and lined with hair, wool, &c. laying five or ſix greeniſh eggs, marked at the larger end with red brown; and the male takes his turn in ſitting. This bird ſoon becomes tame; even old ones being familiar almoſt as ſoon as caught: it lives five or ſix years. Like the chaffinch, it is apt to grow blind if expoſed to the ſun. This ſpecies is alſo pretty common every where on the continent of Europe: but not very frequent in Ruſſia; and is not at all found in Siberia, though it has been met with in Kamtſchatka. It is ſufficiently common both in Cumberland and Scotland: yet in the firſt, it is ſcarce ever obſerved in the winter ſeaſon; but the laſt week in March becomes plentiful, and breeds as in other parts of England.

13. The Bengalenſis, or Bengal groſsbeak, is a trifle bigger than a houſe-ſparrow: the bill is of a fleſh-colour; the irides are whitiſh; the top of the head is of a golden yellow; the upper parts of the body are brown, with paler edges; the ſides of the head and under parts rufous white; acroſs the breaſt is a brown band, uniting to, and of the ſame colour with, the upper parts of the body; the legs are of a pale yellow, the claws grey. This ſpecies (thus deſcribed by Mr Latham) ſeems to be the ſame with the Indian groſsbeak deſcribed as follows in the *Aſiatic Reſearches*. "This little bird, called *bayà* in Hindì, *berbera* in Sanſcrit, *bábúi* in the dialect of Bengal, *cíbù* in Perſian, and *tenawwit* in Arabic, from his remarkably pendant neſt, is rather larger than a ſparrow, with yellow-brown plumage, a yelloviſh head and feet, a light-coloured breaſt, and a conic beak very thick in proportion to his body. This bird is exceedingly common in Hindoſtan: he is aſtoniſhingly ſenſible, faithful, and docile, never voluntarily deſerting the place where his young were hatched, but not averſe, like moſt other birds, to the ſociety of mankind, and eaſily taught to perch on the hand of his maſter. In a ſtate of nature he generally builds his neſt on the higheſt tree that he can find, eſpecially on the palmyra, or on the Indian fig-tree, and he prefers that which happens to overhang a well or a rivulet: he makes it of graſs, which he weaves like cloth, and ſhapes like a large bottle, ſuſpending it firmly on the branches, but ſo as to rock with the wind, and placing it with its entrance downwards to ſecure it from birds of prey. His neſt uſually conſiſts of two or three chambers; and it is the popular belief that he lights them with fire-flies, which he catches alive at night, and confines with moiſt clay or with cow-dung: That ſuch flies are often found in his neſt, where pieces of cow-dung are alſo ſtuck, is indubitable; but as their light could be of little uſe to him, it ſeems probable that he only feeds on them. He may be taught with eaſe to fetch a piece of paper, or any ſmall

Loxia.

small thing that his master points out to him: It is an attested fact, that if a ring be dropped into a deep well, and a signal given to him, he will fly down with amazing celerity, catch the ring before it touches the water, and bring it up to his master with apparent exultation; and it is confidently asserted, that if a house or any other place be shown to him once or twice, he will carry a note thither immediately on a proper signal being made. One instance of his docility I can myself mention with confidence, having often been an eye-witness of it. The young Hindoo women at Benares, and in other places, wear very thin plates of gold, called *ticas*, slightly fixed by way of ornament between their eye-brows; and when they pass through the streets, it is not uncommon for the youthful libertines, who amuse themselves with training bayàs, to give them a signal, which they understand, and send them to pluck the pieces of gold from the foreheads of their mistresses, which they bring in triumph to the lovers. The bayà feeds naturally on grashoppers and other insects; but will subsist, when tame, on pulse macerated in water: his flesh is warm and drying, of easy digestion, and recommended in medical books as a solvent of stone in the bladder or kidneys; but of that virtue there is no sufficient proof. The female lays many beautiful eggs resembling large pearls; the white of them, when they are boiled, is transparent, and the flavour of them is exquisitely delicate. When many bayàs are assembled on a high tree, they make a lively din; but it is rather chirping than singing: Their want of musical talents is however amply supplied by their wonderful sagacity, in which they are not excelled by any feathered inhabitant of the forest."

14. The nigra, or black grosbeak, is about the size of a Canary bird: the bill is black, stout, and deeply notched in the middle of the upper mandible: the plumage is black, except a little white on the fore part of the wing and base of the two first quills: the legs are black. It inhabits Mexico.

15. The minuta, or minute grosbeak, is about the size of a wren: the bill is stout, thick, short, and brown: the upper parts of the plumage are grey brown, the under parts and rump ferruginous chesnut; the fourth, fifth, and sixth quills are white at the base: the legs are brown. It inhabits Surinam and Cayenne.—It is said to keep paired to its mate the whole year; and is a lively, and not very tame bird. It mostly frequents lands which have lain for some time uncultivated; and lives both on fruits and seeds. It makes a roundish nest, the hollow of which is two inches in diameter, composed of a reddish herb, and placed on the trees which it frequents. The female lays three or four eggs.

16. The socia, or sociable grosbeak, is about the size of a bullfinch: The general colour of the body above is a rufous brown, the under parts yellowish: the beak and muzzle are black; the legs brown; and the tail is short. It inhabits the interior country at the Cape of Good Hope; where it was discovered by Mr Paterson.—These birds, according to our author, live together in large societies, and their mode of nidification is extremely uncommon. They build in a species of *Mimosa* which grows to an uncommon size; and which they seem to have selected for that purpose, as well on account of its ample head, and the great strength of its branches, calculated to admit and to support the extensive buildings which they have to erect, as for the tallness and smoothness of its trunk, which their great enemies, the serpent-tribe, are unable to climb. The method in which the nests themselves are fabricated, is highly curious. In the one described by Mr Paterson there could be no less a number (he says) than from 800 to 1000 residing under the same roof†. He calls it a roof, because it perfectly resembles that of a thatched house; and the ridge forms an angle so acute and so smooth, projecting over the entrance of the nest below, that it is impossible for any reptile to approach them. The industry of these birds "seems almost equal (says our author) to that of the bee; throughout the day they appear to be busily employed in carrying a fine species of grass, which is the principal material they employ for the purpose of erecting this extraordinary work, as well as for additions and repairs. Though my short stay in the country was not sufficient to satisfy me by ocular proof, that they added to their nest as they annually increased in numbers, still from the many trees which I have seen borne down with the weight, and others which I have observed with their boughs completely covered over, it would appear that this is really the case; when the tree which is the support of this aerial city is obliged to give way to the increase of weight, it is obvious that they are no longer protected, and are under the necessity of rebuilding in other trees. One of these deserted nests I had the curiosity to break down, so as to inform myself of the internal structure of it, and found it equally ingenious with that of the external. There are many entrances, each of which forms a regular street, with nests on both sides, at about two inches distance from each other. The grass with which they build is called the Boshman's grass: and I believe the seed of it to be their principal food; though, on examining their nests, I found the wings and legs of different insects. From every appearance, the nest which I dissected had been inhabited for many years; and some parts of it were much more complete than others: this therefore I conceive nearly to amount to a proof, that the animals added to it at different times, as they found necessary, from the increase of the family, or rather of the nation or community."

Loxia.

† See the Plate referred to at Mimosa.

Journies into the country of the Hottentots 133. &c.

17. The tridactyla, or three-toe'd grosbeak (the guifso balito of *Buffon*), has only three toes, one before and one behind. The bill is toothed on the edges: the head, throat, and fore-part of the neck are of a beautiful red, which is prolonged in a narrow band quite to the vent; the upper part of the neck, back, and tail, are black; the wing coverts brown, edged with white; quills brown, with greenish edges; and legs a dull red: the wings reach half way on the tail.—This species inhabits Abyssinia; where it frequents woods, and is a solitary species. It feeds on kernels of seeds, which it breaks with ease with its bill. The name in its native place is *guifso batito dimmo-won jerck*. Buffon's figure is from Mr Bruce's drawings.

There are 76 other species of this genus; the whole number, besides varieties, enumerated in the *Syst. Nat.* (Gmelin), and in Mr Latham's *Index Ornith.* being 93.

Loxia.

A

B

C

D

E

F

Lernæa.

Libellula.

Lepisma.

3 2 1

Lumbricus marinus.

A. Bell Prin. Wal. Sculptor fecit.

Loyola || Lubec.

On Plate CCLXXIV. are given ſpecimens of ſix, *viz.* A, the Cærulea; B, the Longicauda; C, the Socia; D, the Cardinalis; E, the Nigra; F, the Violacea.

LOYOLA (Ignatius). See IGNATIUS.

LOZENGE, in heraldry, a four-cornered figure, reſembling a pane of glaſs in old caſements. See HERALDRY, p. 455. col. 1. Though all heralds agree, that ſingle ladies are to place their arms on lozenges, yet they differ with reſpect to the cauſes that gave riſe to it. Plutarch ſays, in the life of Theſeus, that in Megara, an ancient town of Greece, the tomb-ſtones, under which the bodies of the Amazons lay, were ſhaped after that form; which ſome conjecture to be the cauſe why ladies have their arms on lozenges. *S. Petra Sancta* will have this ſhield to repreſent a *cuſhion*, whereupon women uſed to ſit and ſpin, or do other houſewifery. Sir J. Ferne thinks it is formed from the ſhield called *teſſera*, which the Romans finding unfit for war, did allow to women to place their enſigns upon, with one of its angles always uppermoſt.

LOZENGES, among jewellers, are common to brilliant and roſe diamonds. In brilliants, they are formed by the meeting of the ſkill and ſtar facets on the bezil; in the latter, by the meeting of the facets in the horizontal ribs of the crown. See FACETS.

LOZENGE is alſo a form of medicine, made into ſmall pieces, to be held or chewed in the mouth till they are melted there: the ſame with what are otherwiſe called *trochiſci*, "troches."

LUBEC, a city and port-town of Germany, in the circle of Lower Saxony and duchy of Holſtein, in E. Long. 10. 35. N. Lat. 54. 20. It ſtands at the conflux of ſeveral rivers, the largeſt of which is the Trave, 12 miles from the Baltic, where it has a fine harbour, and 40 north-eaſt of Hamburg. By the Steckenitz, another of thoſe rivers, it has a communication with the Elbe, and conſequently with the German ocean. The city lies on the ſide of a hill, with the Trave, increaſed by the Steckenitz on the one ſide, and the Wackenitz on the other; and is ſtrongly fortified with baſtions, moats, walls, and ramparts; the laſt of which are planted with trees, and form an agreeable walk. Lubec being formerly the chief of the Hanſe towns, was very powerful in conſequence of the vaſt trade it carried on; but a great part of that trade is now transferred to Hamburg: however, it is ſtill ſaid to employ 150 of its own ſhips, and has a great ſhare of the Baltic trade. It is about two miles in length, and more than one in breadth. The houſes are all of ſtone, but old-faſhioned. Several of the ſtreets have on each ſide rows of lime-trees, with canals in the middle, like thoſe of Holland. The public ſtructures conſiſt of the ancient cathedral of the biſhopric of Lubec, and ſeveral other Lutheran churches; a nunnery for 22 ladies, with an abbeſs and prioreſs; a poor-houſe, an alms-houſe, and houſe of correction; an orphan-houſe; an hoſpital dedicated to the Holy-Ghoſt; a houſe in which poor travellers are entertained three days, and then ſent forward with a paſs; but ſuch as happen to be ſick, are provided with all neceſſaries till they recover or die; the city-armoury, a grammar-ſchool of ſeven claſſes, the Calviniſt church, and the Popiſh chapel. The deputies of the Hanſe-towns uſed to meet here formerly in the town-houſe. An alliance ſtill ſubſiſts between Lubec, Hamburg, and Bremen; and theſe cities, under the name of *Hanſe-towns*, negociate treaties with foreign powers. Here are divers manufactures, and the city's territory is about 60 miles in compaſs. In the diet of the empire Lubec is poſſeſſed of the third ſeat among the Rheniſh imperial cities; and among thoſe of the circle, has the firſt. In the matricula, its aſſeſſment is 480 florins, and to the chamber of Wetzlar it pays 557 rix-dollars and 88 kruitzers. The city is a republic within itſelf, and both makes and executes laws in regard to civil and criminal matters, &c. A father and ſon, or two brothers, cannot be in the regency at the ſame time. The famous league of the Hanſe-towns was begun here in 1164. This city had its charter of privileges from the emperor Frederic II. Formerly it carried on wars, both offenſive and defenſive, for ſeveral years, not only againſt the dukes of Mecklenburg, but againſt the kings of Sweden and Denmark; particularly in 1428, when it fitted out 250 ſhips of force againſt Eric X. king of Denmark. There are about 20 churches in Lubec, with lofty ſteeples or ſpires. The Trave brings ſhips of burden into the very heart of the city; but the largeſt unload at Travemunde, *i. e.* the mouth of the Trave, eight or ten miles diſtant. Formerly it is ſaid to have employed no leſs than 600 ſhips. In the famous cellar here, it is ſaid there is wine 200 years old. The church of St Mary's, a noble lofty pile, is ſupported by tall pillars, all of one ſtone each, and has a high ſpire, covered with gilt lead. The town's garriſon conſiſts of about 700 or 800 men. The revenue of its Lutheran biſhop, though he is a prince of the empire, is ſaid not to exceed 3000 pounds.

Lubec || Lubin.

LUBEN, a city of Germany, in the marquiſate of Lower Luſatia. It is ſituated on the river Spree, and is the capital of a ſmall circle of the ſame name. It is the ſeat of the diets, and of the chief tribunals and offices; and has ſeveral churches, with a noble land-houſe and hoſpital. E. Long. 14. 25. N. Lat. 52. 0.

LUBIENIETSKI (Staniſlaus), a Poliſh gentleman, deſcended from a noble family, and born at Cracow in 1623, was educated by his father with great attention. He became a celebrated Socinian miniſter; and took great pains to obtain a toleration from the German princes for his Socinian brethren. His labours, however, were ineffectual; being himſelf perſecuted by the Lutheran miniſters, and baniſhed from place to place; until at length he was baniſhed out of the world, with his two daughters, by poiſon, his wife narrowly eſcaping, in 1675. We have of his writing *A hiſtory of the reformation in Poland; A treatiſe on comets;* with other works in Latin.

LUBIN (Eilhard), was profeſſor of poetry in the univerſity of Roſtock in 1595: and ten years after, was promoted to the profeſſorſhip of divinity. He wrote notes on Anacreon, Juvenal, Perſius, &c. and ſeveral other works; but that which made the moſt noiſe is a Treatiſe on the nature and origin of evil, intitled, *Phoſphorus de cauſa prima et natura mali*, printed at Roſtock in 1596; in which we have a curious hypotheſis to account for the origin of moral evil. He ſuppoſed two co-eternal principles; not *matter* and *va-*

Lublin ‖ Lucanus.

cuum, as Epicurus did; but God, and *Nihilum* or *Nothing*. This being publiſhed againſt by Grawer, was defended by Lubin; but after all, he is deemed better acquainted with polite literature than with divinity. He died in 1621.

LUBLIN, a handſome and conſiderable town of Poland, capital of the palatinate of the ſame name, with a citadel, a biſhop's ſee, an univerſity, and a handſome Jewiſh ſynagogue. Here the judicial courts for all Poland are held. It has three fairs, frequented by merchants from all nations. It is ſeated on the river Byſtrzna. E. Long. 22. 31. N. Lat. 51. 26.

LUCA, (anc. geog.), a town of Etruria, on the river Auſer; a colony and a municipium. Now *Lucca*, capital of the republic of that name, near the river Sechia. E. Long. 11. 20. Lat. 43. 45.

LUCANIA, a country of Italy, and a part of Magna Græcia; bounded on the north by the river Silarus by which it was ſeparated from the Picentini, and by the river Bradanus by which it was parted from the Apuli Peucetii; on the ſouth by the Laus, which ſeparated it from the Bruttii; on the eaſt by the Sinus Tarentinus; and on the weſt by the Tuſcan ſea. *Lucani*, the people, deſcendants of the Samnites. *Lucanus* the epithet, (Horace). *Lucæ boves* denoted elephants; firſt ſeen in Pyrrhus's wars in Lucania, whence the appellation (Pliny).

LUCANUS (Marcus Annæus), a Latin poet, born at Corduba in Spain, about A. C. 39. He was the ſon of Annæus Mela, the youngeſt brother of Seneca; and was conveyed to Rome from the place of his nativity at the age of eight months: a circumſtance, as his more indulgent critics obſerve, which ſufficiently refutes the cenſure of thoſe who conſider his language as provincial. At Rome he was educated under the Stoic Cornutus, ſo warmly celebrated by his diſciple Perſius the ſatiriſt, who was the intimate friend of our poet. In the cloſe of his education, Lucan is ſaid to have paſſed ſome time at Athens. On his return to Rome he roſe to the office of quæſtor, before he had attained the legal age. He was afterwards inrolled among the augurs; and married a lady of noble birth, and of a moſt amiable character. Lucan had for ſome time been admitted to familiarity with Nero, when the emperor choſe to contend for poetical honours by the public recital of a poem he had compoſed on Niobe; and ſome verſes of this imperial production are ſuppoſed to be preſerved in the firſt ſatire of Perſius. Lucan had the hardineſs to repeat a poem on Orphæus, in competition with that of Nero; and, what is more remarkable, the judges of the conteſt were juſt and bold enough to decide againſt the emperor. From hence Nero became the perſecutor of his ſucceſsful rival, and forbade him to produce any poetry in public. The well-known conſpiracy of Piſo againſt the tyrant ſoon followed; and Tacitus, with his uſual ſarcaſtic ſeverity, concludes that Lucan engaged in the enterprize from the poetical injuries he had received: "a remark (ſays Mr Hayley*, who has endeavoured to refute the imputation) which does little credit to the candour of the hiſtorian; who might have found a much nobler, and, I will add, a more probable motive for his conduct, in the generous ardor of his character, and his paſſionate adoration of freedom. In the ſequel of his narration, Tacitus alleges a charge againſt our poet, which, if it were true, muſt lead us to deteſt him as the moſt abject of mankind. The hiſtorian aſſerts, that Lucan, when accuſed of the conſpiracy, for ſome time denied the charge; but corrupted at laſt by a promiſe of impunity, and deſirous to atone for the tardineſs of his confeſſion, accuſed his mother Atilla as his accomplice. This circumſtance is ſo improbable in itſelf, and ſo little conſonant to the general character of Lucan, that ſome writers have treated it with contempt, as a calumny invented by Nero, to vilify the object of his envious abhorrence. But the name of Tacitus has given ſuch an air of authority to the ſtory, that it may ſeem to deſerve a more ſerious diſcuſſion, particularly as there are two ſubſequent events related by the ſame hiſtorian, which have a tendency to invalidate the accuſation ſo injurious to our poet. The events I mean are, the fate of Annæus, and the eſcape of Atilla, the two parents of Lucan. The former died in conſequence of an accuſation brought againſt him, after the death of his ſon, by Fabius Romanus, who had been an intimate with Lucan, and forged ſome letters in his name, with the deſign of proving his father concerned in the conſpiracy. Theſe letters were produced to Nero, who ſent them to Annæus, from an eager deſire, ſays Tacitus, to get poſſeſſion of his wealth. From this fact two inferences may be drawn, according to the different lights in which it may be conſidered:—If the accuſation againſt Annæus was juſt, it is clear that Lucan had not betrayed his father, and he appears the leſs likely to have endangered by his confeſſion the life of a parent, to whom he owed a ſtill tenderer regard —If Annæus was not involved in the conſpiracy, and merely put to death by Nero for the ſake of his treaſure, we may the more readily believe, that the tyrant who murdered the father from avarice, might calumniate the ſon from envy. But the eſcape of Atilla affords us the ſtrongeſt reaſon to conclude that Lucan was perfectly innocent of the abject and unnatural treachery of which Tacitus has ſuppoſed him guilty. Had the poet really named his mother as an accomplice, would the vindictive and ſanguinary Nero have ſpared the life of a woman whoſe family he deteſted, particularly when other females were put to death for their ſhare in the conſpiracy? That Atilla was not in that number, the hiſtorian himſelf informs us in the following remarkable ſentence, "Atilla mater Annæi Lucani, ſine abſolutione, ſine ſupplicio, diſſimulata;" thus tranſlated by Gordon: "The information againſt Atilla, the mother of Lucan, was diſſembled; and, without being cleared, ſhe eſcaped unpuniſhed."

The preceding remarks will, our author hopes, vindicate to every candid mind the honour of Lucan, whoſe firmneſs and intrepidity of character are indeed very forcibly diſplayed in that picture of his death which Tacitus himſelf has given us. He was condemned to have his veins cut, as his uncle Seneca had before him. Lucan, "while his blood iſſued in ſtreams, perceiving his feet and hands to grow cold and ſtiffen, and life to retire by little and little to the extremities, while his heart was ſtill beating with vital warmth, and his faculties nowiſe impaired, recollected ſome lines of his own, which deſcribed a wounded ſoldier expiring in a manner that reſembled this. The lines themſelves he rehearſed; and they were the laſt words he ever uttered." The critics differ concerning the verſes

Lucanus.

* In the *Notes* to his *Second Epiſtle on Epic Poetry*.

Lucanus. verſes of the Pharſalia which the author quoted in ſo memorable a manner. The two paſſages he is ſuppoſed to have repeated are the following; of which Lipſius contends for the latter.

Sanguis erant lacrymæ: quæcunque foramina nova
Humor, ab his largus manat cruor: ora redundant,
Et patulæ nares: ſudor rubet: omnia plenis
Membra fluunt venis: totum eſt pro vulnere corpus.
Lib. ix. 814.

Now the warm blood at once, from every part,
Ran purple poiſon down, and drain'd the fainting heart.
Blood falls for tears; and o'er his mournful face
The ruddy drops their tainted paſſage trace.
Where'er the liquid juices find a way,
There ſtreams of blood, there crimſon rivers ſtray.
His mouth and guſhing noſtrils pour a flood,
And e'en the pores ouze out the trickling blood;
In the red deluge all the parts lie drown'd,
And the whole body ſeems one bleeding wound.
ROWE.

Scinditur avulſus; nec ſicut vulnere ſanguis
Emicuit lentus; ruptis cadit undique venis,
Diſcurſuſque animæ, diverſa in membra meantis,
Interceptus aquis. Lib. iii. v. 638.

No ſingle wound the gaping rupture ſeems,
Where trickling crimſon wells in ſlender ſtreams;
But, from an op'ning horrible and wide,
A thouſand veſſels pour the burſting tide:
At once the winding channel's courſe was broke,
Where wand'ring life her mazy journey took;
At once the currents all forgot their way,
And loſt their purple in the azure ſea. ROWE.

Such was the death of Lucan before he had completed his 27th year.—His wife, Polla Argentaria, is ſaid to have tranſcribed and corrected the three firſt books of the Pharſalia after his death. It is much to be regretted (Mr Hayley obſerves) that we poſſeſs not the poem which he wrote on the merits of this amiable and accompliſhed woman; but her name is immortalized by two ſurviving poets of that age. The veneration which ſhe paid to the memory of her huſband is recorded by Martial; and more poetically deſcribed in that pleaſing and elegant little production of Statius, *Genethliacon Lucani*, a poem ſaid to have been written at the requeſt of Argentaria. The author, after invoking the poetical deities to attend the ceremony, touches with great delicacy and ſpirit on the compoſitions of Lucan's childhood, which are loſt, and the Pharſalia, the production of his early youth: he then pays a ſhort compliment to the beauty and talents of Argentaria; laments the cruel fate which deprived her ſo immaturely of domeſtic happineſs; and concludes with an addreſs to the ſhade of Lucan, which, with Mr Hayley's tranſlation, we ſhall ſubjoin in a Note, as it ſeems to furniſh a ſtrong preſumption of Lucan's innocence in regard to one of the accuſations mentioned above (A). "Had he been really guilty of baſely endangering the life of his mother (ſays Mr Hayley), it is not probable that his wife would have honoured his memory with ſuch enthuſiaſtic veneration; or that Statius, in verſes deſigned to do him honour, would have alluded to *the mother* of Nero. If his character as a man has been injured by the hiſtorian (continues Mr Hayley), his poetical reputation has been treated not leſs injuriouſly by the critics. Quintilian, by a frivolous diſtinction, diſputes his title to be claſſed among the poets; and Scaliger ſays, with a brutality of language diſgraceful only to himſelf, that he ſeems rather to *bark* than to *ſing*. But theſe inſults may appear amply compenſated, when we remember, that in the moſt poliſhed nations of modern Europe the moſt elevated and poetic ſpirits have been his warmeſt admirers; that in France he was idolized by Corneille, and in England tranſlated by Rowe.—The ſevereſt cenſures on Lucan have proceeded from thoſe who

(A) At tu, ſcu rapidum poli per axem
Famæ curribus arduis levatus,
Qua ſurgunt animæ potentiores,
Terras deſpicis, et ſepulchra rides:
Seu pacis meritum nemus recluſæ
Felix Elyſiis tenes in oris,
Quo Pharſalica turba congregatur;
Et te nobile carmen inſonantem
Pompeii comitantur et Catones:
Tu magna ſacer et ſuperbus umbra
Neſcis Tartaron, et procul nocentum
Audis verbera, pallidumque viſa
Matris lampade reſpicis Neronem.
Adſis lucidus; et vocante Polla
Unam, quæſo, diem deos ſilentum
Exores; ſolet hoc patere limen
Ad nuptas redeuntibus maritis.
Hæc te non thiaſis procax doloſis
Falſi numinis induit figuras;
Ipſum ſed colit, et frequentat ipſum
Imis altius inſitum medullis;
Ac ſolatia vana ſubminiſtrat
Vultus, qui ſimili notatus auro
Stratis prænitet, excubatque ſomno
Securæ. Procul hinc abite mortes;
Hæc vitæ genitalis eſt origo;
Cedat luctus atrox, geniſque manent
Jam dulces lacrymæ, dolorque feſtus
Quicquid fleverat ante nunc adoret.

But you, O! whether to the ſkies
On Fame's triumphant car you riſe,
(Where mightier ſouls new life aſſume)
And mock the confines of the tomb;
Or whether in Elyſium bleſt
You grace the groves of ſacred reſt,
Where the Pharſalian heroes dwell;
And, as you ſtrike your epic ſhell,
The Pompeys and the Catos throng
To catch the animating ſong;
Of Tartarus the dread controul
Binds not your high and hallow'd ſoul:
Diſtant you hear that wailing coaſt,
And ſee the guilty Nero's ghoſt
Grow pale with anguiſh and affright,
His mother flaſhing on his ſight.
Be preſent to your Polla's vows,
While to your honour'd name ſhe bows!
One day let your intreaties gain
From thoſe who rule the ſhadowy train!
Their gates have op'd to bleſs a wife,
And given a huſband back to life.
In you the tender fair invites
No fancied god with frantic rites:
You are the object of her prayers,
You in her inmoſt heart ſhe bears:
And, ſtampt on mimic gold, your head
Adorns the faithful mourner's bed,
And ſooths her eyes before they cloſe,
The guardian of her chaſte repoſe.
Away with all funereal ſtate!
From hence his nobler life we date:
Let mourning change the pang ſevere
To fond devotion's grateful tear!
And feſtal grief, its anguiſh o'er,
What it lamented, now adore!

Lucanus, Lucar.

have unfairly compared his language to that of Virgil: but how unjuſt and abſurd is ſuch a compariſon! it is comparing an uneven block of porphyry, taken rough from the quarry, to the moſt beautiful ſuperficies of poliſhed marble. How differently ſhould we think of Virgil as a poet, if we poſſeſſed only the verſes which he wrote at that period of life when Lucan compoſed his Pharſalia! In the diſpoſition of his ſubject, in the propriety and elegance of diction, he is undoubtedly far inferior to Virgil: but if we attend to the bold originality of his deſign, and to the vigour of his ſentiments; if we conſider the Pharſalia as the rapid and uncorrected ſketch of a young poet, executed in an age when the ſpirit of his countrymen was broken, and their taſte in literature corrupted; it may juſtly be eſteemed as one of the moſt noble and moſt wonderful productions of the human mind."—Lucan wrote ſeveral poems; but we have none remaining beſide his *Pharſalia*, of which an excellent Engliſh verſion has been given by Mr Nicholas Rowe.

LUCANUS, the STAG-BEETLE, in zoology; a genus of inſects of the order coleoptera. The antennæ end in a club or knob, which is compreſſed or flattened on one ſide, and divided into ſhort laminæ reſembling the teeth of a comb; the jaws are porrected or advanced before the head, and are dentated. There are 20 ſpecies. The largeſt, as well as the moſt ſingular, is the cervus; which is eaſy to be known by two large moveable maxillæ, reſembling in form the horns of a ſtag, which project from its head, and have in a ſpecial manner acquired it the appellation of Stag-Beetle. Thoſe maxillæ, broad and flat, equal to one third of the inſect's length, have in the middle, towards their inner part, a ſmall branch, and at their extremity are forked. Beſides this, they have ſeveral ſmall teeth throughout their whole length. The head that bears theſe maxillæ is very irregular, very broad and ſhort. The thorax is ſomething narrower than the head and body, and margined round. The elytra are very plain, without either ſtreaks or lines. The whole animal is of a deep brown colour. It is commonly found upon the oak, but is ſcarce in the neighbourhood of London, and though the largeſt of coleopterous inſects to be met with in this part of the world, it is much ſmaller than thoſe of the ſame ſpecies that are found in woody countries. This creature is ſtrong and vigorous, and its horns, with which it pinches ſeverely, are carefully to be avoided.—The jaws are ſometimes as red as coral, which gives this inſect a very beautiful appearance; the female is diſtinguiſhed by the ſhortneſs of the jaws, which are not half ſo long as thoſe of the male. —Theſe inſects feed on the liquor that oozes from oaks, which they ſuck with their trunk or tongue. The females depoſit their eggs in the trunks of decayed trees, ſuch as the oak and the aſh. The larvæ or grubs lodge under the bark and in the hollow of old trees, which they eat into and reduce into fine powder, and there transform themſelves into chryſalids. They are common in Kent and Suſſex, and are ſometimes met with in other parts of England. The porrected jaws are particularly uſeful to theſe animals, in ſtripping off the bark from trees, and affixing themſelves thereby to the tree, while they ſuck with their trunk the juice that oozes from it.

Plate CCLXXV.

LUCAR DE BARAMEDA (St), a handſome and conſiderable town of Spain, with a very good harbour, well defended, in Andaluſia. It was once the greateſt port in Spain, before the galleons unloaded their treaſure at Cadiz. It is ſeated at the mouth of the river Quadalquiver. W. Long. 6. 5. N. Lat. 36. 40.

Lucar ‖ Lucas.

LUCAR *de Guadiana* (St), a ſtrong town of Spain, in Andaluſia, on the confines of Algarve; ſeated on the river Guadiana, with a little harbour. W. Long. 5. 59. N. Lat. 37. 32.

LUCAR *la Major* (St), a ſmall town of Spain, in Andaluſia, with the title of a duchy. It is ſeated on the river Guadiana, in W. Long. 6. 32. N. Lat. 37. 21.

LUCARIA, a feaſt celebrated at Rome on the 18th of July, in memory of the flight of the Romans into a great wood, where they found an aſylum, and ſaved themſelves from deſtruction. This wood, in which they found protection, was ſituated between Tyber and the *Via Salaria*. The enemies from whom the Romans fled were the Gauls.—On this feſtival, Plutarch tells us, it was cuſtomary to pay the actors, and ſuch as contributed to the public amuſement, with the money ariſing from the felling of wood. This money was called *lucar*. It is obvious, from what has been obſerved, that *lucar* and *lucaria* are derived from *lucus*, a grove.

LUCAS (Jacobs), an eminent artiſt, more generally known by the name of *Lucas van* LEYDEN, or *Hugenſe*, was born at Leyden in 1494. He received his firſt inſtructions in the art of painting from his father Hugues Jacobs; but completed his ſtudies in the ſchool of Cornelius Engelbrecht. He gained much money by his profeſſion; and being of a generous turn of mind, he ſpent it freely, dreſſed well, and lived in a ſuperior ſtyle. It is ſaid, that, a few years before his death, he made a tour into Zealand and Brabant; and during his journey, a painter of Fluſhing, envious of his great abilities, gave him poiſon at an entertainment; which, though very ſlow, was too fatal in its effect, and put an end to his life, after ſix years languiſhing under its cruel influence. Others, denying the ſtory of the poiſon, attribute his death to his inceſſant induſtry. The ſuperiority of this artiſt's genius manifeſted itſelf in his infancy: for his works, even from the age of nine, were ſo excellent, as to excite the admiration of all contemporary artiſts; and when he was about 15, he painted a St Hubert, which gained him great applauſe. His tone of colouring (Mr Pilkington obſerves) is good, his attitudes (making a reaſonable allowance for the ſtiff German taſte) are well-choſen, his figures have a conſiderable expreſſion in their faces, and his pictures are very highly finiſhed. He endeavoured to proportion the ſtrength of his colouring to the different degrees of diſtance in which his objects were placed: for in that early time, the true principles of perſpective were but little known, and the practice of it was much leſs obſerved. In the town-hall at Leyden, the moſt capital picture of Lucas, the ſubject of which is the Laſt Judgement, is preſerved with great care; the magiſtrates having refuſed very large ſums which have been offered for it.

This artiſt painted not only in oil, but alſo in diſtemper and upon glaſs. Nor was he leſs eminent for his engraving than for his painting. He carried on a familiar and friendly correſpondence with Albert

Lucas. Durer, who was his cotemporary; and, it is ſaid, that as regularly as Albert Durer publiſhed one print, Lucas publiſhed another, without the leaſt jealouſy on either ſide, or wiſh to depreciate each other's merit. And when Albert came into Holland upon his travels, he was received by Lucas in a moſt cordial and affectionate manner. His ſtyle of engraving, however, according to Mr Strutt, differed conſiderably from that of Albert Durer, "and ſeems evidently to have been founded upon the works of Iſrael van Mechlen. His prints are very neat and clear, but without any powerful effect. The ſtrokes are as fine and delicate upon the objects in the front, as upon thoſe in the diſtances; and this want of variety, joined with the feebleneſs of the maſſes of ſhadow, give his engravings, with all their neatneſs, an unfiniſhed appearance, much unlike the firm ſubſtantial effect which we find in the works of Albert Durer. He was attentive to the minutiæ of his art. Every thing is carefully made out in his prints, and no part of them is neglected. He gave great character and expreſſion to the heads of his figures; but, on examination of his works, we find the ſame heads too often repeated. The hands and feet are rather mannered than correct; and when he attempted to draw the naked figure, he ſucceeded but very indifferently. He affected to make the folds of his draperies long and flowing; but his female figures are frequently ſo exceſſively loaded with girdles, bandages, and other ornamental trappings, that much of the elegance of the deſign is loſt. He engraved on wood, as well as on copper; but his works on the former are by no means numerous. They are, however, very ſpirited; tho' not equal, upon the whole, to thoſe of his friend Albert. The prints of this maſter are pretty numerous, but very ſeldom met with complete; eſpecially fine impreſſions of them. For though they are, generally ſpeaking, executed with the graver only, yet, from the delicacy of the execution, they ſoon ſuffered in the printing. Of his engravings the few following may be mentioned as among the principal. 1. *Mahomet ſleeping, with a prieſt murdered by his ſide, and another figure ſtealing his ſword*, a middling-ſized upright plate, dated 1508, ſaid to be one of his moſt early productions. 2. An *ecce homo*, a large plate, lengthwiſe, dated 1510. 3. *The crucifixion on Mount Calvary*, the ſame. 4. *The wiſe mens offering*, the ſame, dated 1513. 5. *Return of the prodigal ſon*, a middling-ſized plate, lengthwiſe, dated 1518. 6. A large print lengthwiſe called *the dance of Magdalen*, dated 1519. 7. His own *portrait*, a ſmall upright plate, dated 1525. 8. *David playing before Saul*, a middling-ſized upright plate, dated This is a very fine print; the expreſſion of Saul's countenance, in particular, is admirable. 9. A print known by the name of *Uleſpiegle*, which is the ſcarceſt of all the works of this maſter. It is in the collection of the king of France; and ſaid by Marolles, and other maſters, to be unique. But Baſan informs us, that M. Mariette had alſo an impreſſion of this plate; and it has been ſince found in one or two other collections. It repreſents a travelling bag-piper with his family; himſelf playing as he goes along, and carrying two children in a baſket at his back; his wife trudging by his ſide, ſupporting with one hand an infant on her ſhoulder, and with the other leading an aſs loaded with two baſkets, having two children in each; and another child going before, with a little dog, completes the ſingular groupe. This rare print is dated 1520, and is known to have been ſold for 16 louis-d'ors.— It is nearly 7½ inches high by 4¾ broad; and has been twice copied. One of the copies is the reverſe way: but the other is the ſame way with the original; and though not ſo well executed, might without a compariſon be miſtaken for it.

Lucas || Luceria.

Lucas (Richard), D. D. a learned Engliſh divine, was born in 1648, and ſtudied at Oxford: after which he entered into holy orders, and was for ſome time maſter of the free ſchool at Abergavenny. Being eſteemed an excellent preacher, he became vicar of St Stephen's, Coleman ſtreet, in London, and lecturer of St Olave's in Southwark. He was doctor of divinity; and in 1696 was inſtalled prebendary of Weſtminſter. His ſight began to fail him in his youth; and he totally loſt it in his middle age. He was greatly eſteemed for his piety and learning; and publiſhed ſeveral works, particularly, 1. Practical Chriſtianity. 2. An inquiry after happineſs. 3. Several ſermons. 4. A Latin tranſlation of the whole duty of man. He died in 1715.

LUCCA, a ſmall republic of Italy on the coaſt of the Mediterranean, between the territory of Genoa on the weſt, Modena on the north, and Tuſcany on the eaſt. According to Keyſler, it is only about 30 miles in circumference, but is exceeding fertile and populous. It contains, beſides the city of Lucca, 150 villages. The number of inhabitants are computed at 120,000. The government is lodged in a gofalonier, whoſe power is much the ſame with that of the doges of Venice and Genoa. He is aſſiſted by nine counſellors: but the power of all the ten continues only for two months; during which time they live in the ſtate-palace, and at the public expence. They are choſen out of the great council, which conſiſts of 240 nobles; but even this council is changed by a new election every two years. The revenues of the republic are about 400,000 ſcudi or crowns; out of which they maintain 500 men by way of regular force, and 70 Swiſs as a guard to their acting magiſtrates. The city of Lucca is ſituated in a plain, terminating in moſt delightful eminences, adorned with villas, ſummer-houſes, corn-fields, and plantations of every kind; ſo that nothing either for uſe or pleaſure is here wanting. The city, which is about three Italian miles in circumference, has regular well-lined fortifications; and its ſtreets, though irregular, are wide, well paved, and full of handſome houſes. The number of its inhabitants are computed to be above 40,000; and they carry on large manufactures, eſpecially of ſilk-ſtuffs. Lucca has a biſhop, who enjoys ſeveral extraordinary privileges; and its cathedral is Gothic. The city ſtands in E. Long. 11. 27. N. Lat. 43. 52.

LUCENTI, Lucentia, or *Lucentum*, a town of the Hither Spain, now Alicant, a ſea-port of Valencia. W. Long. 32′, Lat. 38° 37′.

LUCERES, in Roman antiquity, the third in order of the three tribes into which Romulus divided the people, including all foreigners; ſo called from the *lucus* or grove, where Romulus opened an aſylum.

LUCERIA (anc. geog.), a town of Apulia in Italy; which in Strabo's time ſtill exhibited marks of Diomed's

Lucerius || Lucerne.

Diomed's fovereignty in thoſe parts. Ptolemy has *Nuceria*; whether from miſtake, or the cuſtom of his time, uncertain. Now *Nocera de Pagani*, in the kingdom of Naples. E. Long. 15. 0. N. Lat. 40. 40.

LUCERIUS, in mythology, a name given to Jupiter, as *Luceria* was given to Juno, as the deities which gave light to the world.

LUCERNE, one of the 13 cantons of Swiſſerland. It holds the third place among the 13; and is the head of the Catholic cantons. Though leſs than Zuric, and conſequently much leſs than Berne, it is, however, far more extenſive than any of the reſt, being 15 or 16 leagues long, and eight broad. The population is eſtimated at 100,000. Even the mountainous part is not barren, but abundant in wood and paſture, furniſhing cattle, hides, cheeſe, and butter, for exportation. All the north part is fertile in grain, fruit, and hay; ſupplying ſufficient for the conſumption of the inhabitants: but as the mountaineers of the little cantons come to their market for corn, the people of Lucerne purchaſe this commodity from other parts of Swiſſerland, but eſpecially from Alſace and Suabia. Their manufactures are very inconſiderable; conſiſting only in a little ſilk and cotton thread. —The government is oligarchical. The councils are choſen from among 500 citizens only. The great council of 64 members is the nominal ſovereign; but in fact the power reſides in the ſenate, or little council of 36, having for their chiefs the two Avoyers.—The whole canton profeſſes the Roman Catholic religion. The pope's nuncio, with the title of legate *a latere*, uſually reſides at Lucerne.—They threw off the Auſtrian yoke in 1352, and by entering into a perpetual alliance with the three ancient cantons, they gave ſuch weight to the confederacy, as to enable it in 1386 to reſiſt all the efforts of the enemy at the bloody battle of Sempach.

The *town of Lucerne* is ſituated at the extremity of a moſt beautiful lake of the ſame name, where the river Reuſs iſſues from it. The buildings are ancient, and the ſtreets narrow; nor is Lucerne populous in proportion to its extent, the inhabitants being only between 3 and 4000. Since this is the great paſſage to Italy by Mount St Gothard, and the merchandize which paſſes the Alps on mules, and is to be tranſported by the rivers Reuſs, Aar, and Rhine, is all depoſited here, it might have a flouriſhing trade if arts and manufactures were attended to. The Reuſs ſeparates the town into two unequal parts, which are connected by three bridges; one wide for carriages; and two narrow covered ones for foot paſſengers: beſides theſe, there is a fourth over an arm of the lake, to paſs to the cathedral. Three of theſe bridges have old bad paintings of the Dance of Death, and the Hiſtory of the Bible, and of Swiſſerland. They make a commodious dry walk for the inhabitants.—Of religious edifices, the principal are the cathedral, or collegiate church of St Leger; the convent of Cordeliers; the college of the Jeſuits; the convent of Capuchins; and two convents of nuns. Of the ſecular buildings, the hotel de Ville is the principal. The arſenal is well furniſhed. The water tower is remarkable only for its poſition and antiquity: it is ſaid to have been a pharos or lighthouſe.—What greatly attracts moſt the notice of ſtrangers is, a plan in relief of part of the cantons of Lucerne, Zug, and Berne, and the whole of Schweitz, Uri, and Underwald, executed by General Pfiffer on a large ſcale. He has completed about 60 ſquare leagues; the plan is 12 feet long, and nine and a half broad: every mountain is accurately meaſured; and every object diſtinctly placed.

Lucerne, Lucia.

The *Lake of Lucerne* exhibits greater variety and more pictureſque ſcenery than any other of the Swiſs lakes. It is ſeven leagues long in a right line, and three wide about Kuſſnacht; but the ſhape is very irregular. The whole ſouth ſide is bordered by high mountains; but the north exhibits hills of no great height. The narrow gulph that extends towards the weſt, is bordered on the north and north-weſt by mount Pilat, which is a ſingle mountain riſing boldly more than 6000 feet above the lake; and on the ſouth by mount Burgenberg. Stanz-Stadt, belonging to the canton of Underwald, is on this ſide; and hereabouts the lake is deepeſt. Kuſſnacht is on the point of the other gulph, which extends towards the eaſt, and is wider than the former. All the country to the weſt of theſe gulphs, and part of it to the north of the latter, belongs to the canton of Lucerne; but that which is to the ſouth and north-eaſt is dependant on the canton of Zug. All the mountains on the left ſhore of the lake belong to the canton of Underwald; thoſe on the right, partly to the canton of Uri, partly to that of Schweitz, partly to the little republic of Gerſaw, but principally to the canton of Lucerne.

LUCERNE, in botany. See MEDICAGO.—For the culture of this plant, ſee AGRICULTURE, n° 183.

LUCIA (St), one of the Caribbee Iſlands in the Weſt Indies, about 22 miles long, and 11 broad, the middle of it lying in N. Lat. 39. 14. W. Long. 27. 0. It was firſt ſettled by the French in 1650; but was reduced by the Engliſh in 1664, who evacuated it in 1666. The French immediately re-ſettled the iſland, but were again driven away by the Caribbs. As ſoon as the ſavages were gone, the former inhabitants returned, but only for a ſhort time; for being afraid of falling a prey to the firſt privateer that ſhould viſit their coaſts, they removed either to other French ſettlements that were ſtronger, or which they might expect to be better defended. There was then no regular culture or colony at St Lucia; it was only frequented by the inhabitants of Martinico, who came thither to cut wood, and to build canoes, and who had conſiderable docks on the iſland. In 1718 it was again ſettled by the French; but four years after, it was given by the court of London to the duke of Montague, who was ſent to take poſſeſſion of it. This occaſioned ſome diſturbance between the two courts; which was ſettled, however, by an agreement made in 1731, that, till the reſpective claims ſhould be finally adjuſted, the iſland ſhould be evacuated by both nations, but that both ſhould wood and water there. This precarious agreement furniſhed an opportunity for private intereſt to exert itſelf. The Engliſh no longer moleſted the French in their habitations; but employed them as their aſſiſtants in carrying on with richer colonies a ſmuggling trade, which the ſubjects of both governments thought equally advantageous to them. This trade has been more or leſs conſiderable till the treaty of 1763, when the

Lucia, Lucian.

property of St Lucia was secured to the crown of France. After that time the colony flouriſhed conſiderably. In the beginning of the year 1772, the number of white people amounted to 2018 ſouls, men, women, and children; that of the blacks to 663 freemen, and 12,795 ſlaves. The cattle conſiſted of 928 mules or horſes, 207[illegible] head of horned cattle, and 3184 ſheep or goats. There were 38 ſugar plantations, which occupied 978 pieces of land; 5,395,889 coffee-trees; 1,321,600 cocoa plants; and 367 plots of cotton. There were 706 dwelling places. The annual revenue at that time was about 175,000l. which, according to the Abbé Raynal, muſt have increaſed one-eighth yearly for ſome time. It was taken by the Britiſh fleet under admirals Byron and Barrington, in the year 177[illegible]; but was reſtored to France at the peace of 1783.

The ſoil of St Lucia is tolerably good, even at the ſea ſide; and is much better the farther one advances into the country. The whole of it is capable of cultivation, except ſome high and craggy mountains which bear evident marks of old volcanoes. In one deep valley there are ſtill eight or ten ponds, the water of which boils up in a dreadful manner, and retains ſome of its heat at the diſtance of 6000 toiſes from its reſervoirs. The air in the inland parts, like that of all other uninhabited countries, is foul and unwholeſome; but grows leſs noxious as the woods are cleared and the ground laid open. On ſome parts of the ſea-coaſt, the air is ſtill more unhealthy, on account of ſome ſmall rivers which ſpring from the foot of the mountains, and have not ſufficient ſlope to waſh down the ſands with which the influx of the ocean ſtops up their mouths, by which means they ſpread themſelves into unwholeſome marſhes on the neighbouring grounds.

Lucia (St), a high and mountainous iſland of Africa, and one of thoſe of Cape Verde, is about nine leagues long, and lies in the latitude of 16° 18′ N. according to the Engliſh geographers; but according to all others, it is a degree farther to the northward. On the eaſt-ſouth-eaſt ſide is a harbour, with a bottom and ſhore of white ſand; but its beſt road is oppoſite to St Vincent's to the ſouth-weſt, where there are at leaſt 20 fathoms of water. On the weſt ſide there is no water: it abounds with goats, ſea and land fowl, tortoiſes, &c. but whether it hath any inhabitants is not certainly known.

LUCIAN, a celebrated Greek author in the firſt century, was born at Samoſata, of obſcure parents, in the reign of the emperor Trajan. He ſtudied law, and practiſed ſome time as an advocate; but growing weary of the wrangling oratory of the bar, he commenced rhetorician. He lived to the time of Marcus Aurelius, who made him regiſter of Alexandria in Egypt; and, according to Suidas, he was at laſt worried by dogs. Lucian was one of the fineſt wits in all antiquity. His Dialogues, and other works, are written in Greek. In theſe he has joined the uſeful to the agreeable, inſtruction to ſatire, and erudition to elegance; and we every where meet with that fine and delicate raillery which characteriſes the Attic taſte.—Thoſe who cenſure him as an impious ſcoffer at religion, have reaſon on their ſide, if religion conſiſted in the theology of the Pagan poets, or in the extravagant opinions of philoſophers; for he perpetually throws ſuch ridicule on the gods and philoſophers, with their vices, as inſpires hatred and contempt for them; but it cannot be ſaid that he writes any where againſt an over-ruling providence.

Lucianiſts ‖ Lucilius.

LUCIANISTS, or Lucanists, a religious ſect, ſo called from Lucianus, or Lucanus, a heretic of the ſecond century, being a diſciple of Marcion, whoſe errors he followed, adding ſome new ones to them. Epiphanius ſays he abandoned Marcion; teaching that people ought not to marry, for fear of enriching the Creator: and yet other authors mention that he held this error in common with Marcion and other Gnoſtics. He denied the immortality of the ſoul; aſſerting it to be material.

There was another ſect of Lucianiſts, who appeared ſome time after the Arians. They taught, that the Father had been a Father always, and that he had the name even before he begot the Son; as having in him the power or faculty of generation: and in this manner they accounted for the eternity of the Son.

LUCID intervals, the fits of lunatics or maniacs, wherein the phrenzy leaves them in poſſeſſion of their reaſon.

LUCIFER, according to the poets, was the ſon of Jupiter and Aurora: in aſtronomy, Lucifer is the bright planet Venus, which either goes before the ſun in the morning, and is our morning ſtar; or in the evening follows the ſun, and then is called *Heſperus* or the evening ſtar.

LUCIFERA, in mythology, a ſurname given to Diana, under which title ſhe was invoked by the Greeks in childbed. She was repreſented as covered with a large veil, interſperſed with ſtars, bearing a creſcent on her head, and holding in her hand a lighted flambeau.

LUCIFERIANS, a religious ſect, who adhered to the ſchiſm of Lucifer, biſhop of Cagliari, in the fourth century, who was baniſhed by the emperor Conſtantius for having defended the Nicene doctrine concerning the three perſons in the godhead.—St Auguſtine ſeems to intimate, that they believed the ſoul, which they conſidered as of a carnal nature, to be tranſmitted to the children from their fathers. Theodoret ſays, that Lucifer was the author of a new error. The Luciferians increaſed mightily in Gaul, Spain, Egypt, &c. The occaſion of the ſchiſm was, that Lucifer would not allow any acts he had done to be aboliſhed. There were but two Luciferian biſhops, but a great number of prieſts and deacons. The Luciferians bore a peculiar averſion to the Arians.

LUCILIUS (Caius), a Roman knight, and a Latin poet, was born at Sueſſa in Italy, about 140 B. C. He ſerved under Scipio Africanus in the war with the Numantines; and was in great favour with that celebrated general, and with Lælius. He wrote 30 books of ſatires, in which he laſhed ſeveral perſons of quality very ſharply. Some learned men aſcribe the invention of ſatire to him; but M. Dacier has maintained, with great probability, that Lucilius only gave a better turn to that kind of poetry, and wrote it with more wit and humour than his predeceſſors Ennius and Pacuvius had done. His fragments have been carefully collected.

Lucina || Lucullus.

collected by Francis Douza at Leyden in 1599, with notes. But they require ſtill to be better illuſtrated by ſome learned critic.

LUCINA, a goddeſs among the Romans, who preſided over women in labour. Some take her to be Diana, others Juno. She is called *Lucina*, becauſe ſhe brought children to the light; from the Latin word *lux*, "light."

LUCIUS, in ichthyology. See Esox.

LUCONIA. See Manila.

LUCOPHEREA, in ichthyology. See Perca.

LUCRETIA, the famous Roman matron, wife of Collatinus, and the cauſe of the revolution in Rome from a monarchy to a republic: this lady being raviſhed by Sextus, the eldeſt ſon of Tarquin king of Rome, ſtabbed herſelf, 509 B.C. See the article Chastity. The bloody poinard, with her dead body expoſed to the ſenate, was the ſignal of Roman liberty; the expulſion of the Tarquins, and abolition of the regal dignity, was inſtantly reſolved on, and carried into execution. See Rome.

LUCRETIUS, or Titus Lucretius Caius, one of the moſt celebrated of the Latin poets, was born of an ancient and noble Roman family, and ſtudied at Athens, where he became one of Epicurus's ſect. He acquired great reputation by his learning and eloquence; but in the flower of his age fell into a frenzy, occaſioned by a philtre given him by his wife, who was diſtractedly fond of him. Lucretius, during the intervals of his madneſs, put Epicurus's doctrines into verſe, and compoſed his ſix books *De rerum natura*, which are ſtill extant. It is ſaid that he killed himſelf in a fit of madneſs, in the 54th year before the Chriſtian æra, when 51 years old. The moſt correct edition of Lucretius is that of Simon de Coline. The cardinal de Polignac has refuted Lucretius's arguments in his excellent Latin poem intitled *Anti-Lucretius*. His poem *De rerum natura* has been tranſlated into Engliſh by Mr Creech.

LUCRINUS lacus (anc. geog.), a lake of Campania, between Baiæ and Puteoli, famous for its oyſters (Horace, Martial, Juvenal); *Lucrinenſes* (Cicero), the people dwelling on it. Now a perfect bay ſince the earthquake in 1538.

LUCULLUS (Lucius Lucinius), a Roman general, celebrated for his eloquence, his victories, and his riches. In his youth he made a figure at the bar; and being afterwards made quæſtor in Aſia, and prætor in Africa, governed thoſe provinces with great moderation and juſtice. Scarce was he known as a military man, when he twice beat the fleet of Amilcar, and gained two great victories over him. His happy genius was greatly improved by ſtudy; for he employed his leiſure in reading the beſt authors on military affairs. Being made conſul with Aurelius Cotta, during the third war with Mithridates king of Pontus, he was ſent againſt this prince: and this expedition was attended with a ſeries of victories, which did him leſs honour than an act of generoſity towards his colleague; who, willing to take advantage of his abſence to ſignalize himſelf by ſome great exploit, haſtened to fight Mithridates; but was defeated and ſhut up in Calcedonia; where he muſt have periſhed, if Lucullus, ſacrificing his reſentment to the pleaſure of ſaving a Roman citizen, had not flown to his aſſiſtance, and diſengaged him. All Pontus then ſubmitted to Lucullus; who being continued in his government of Aſia, entered the territories of Tigranes, the moſt powerful king in Aſia. That prince marched with a formidable army againſt Lucullus: who defeated him with a handful of men, and killed great numbers of his forces; took Tigranocertes, the capital of his kingdom; and was ready to put an end to the war, when the intrigues of a tribune got him depoſed, and Pompey nominated in his room. Lucullus having brought home prodigious riches, now gave himſelf up to exceſſive luxury; and his table was ſerved with a profuſion till that time unknown. He brought from the Eaſt a great number of books, which he formed into a library, and gave admittance to all men of learning, who frequented it in great numbers. Toward the end of his life, he fell into a kind of madneſs; and Lucullus, his brother, was appointed his guardian. He is ſaid to have been the firſt who brought cherries into Europe, having brought the grafts from the kingdom of Pontus.

Lucus || Ludlow.

LUCUS, in general, denotes a wood or grove ſacred to a deity; ſo called *à lucendo*, becauſe a great number of lights were uſually burning in honour of the god (Iſidorus); a practice common with idolaters, as we learn from Scripture: hence Homer's αγλαον αλσος.

LUD, a Britiſh king mentioned in our old chronicles, and ſaid to have reigned about the year of the world 3878. He is reported to have enlarged and walled about *Troynovant*, or New Troy, where he kept his court, and made it his capital. The name of *London* is hence derived from *Lud's town*; and *Ludgate*, from his being buried near it: but this is only one among many other derivations of the name of London; which are at leaſt equally probable. See London.

LUDI, a term uſed for ſhows and public repreſentations made by the Romans, for the entertainment of the people. See Games.

For an account of the particular games of Greece and Rome, as the Iſthmian, Nemæan, Olympic, &c. ſee Isthmian, &c.

LUDIUS, a celebrated painter, lived in the reign of Auguſtus Cæſar, and excelled in grand compoſitions. He was the firſt who painted the fronts of houſes in the ſtreets of Rome; which he beautified with great variety of landſcapes, and many other different ſubjects.

LUDLOW (Edmund), ſon of Sir Henry Ludlow was born at Maidenhead, and educated in Trinity college, Oxford. His father oppoſing the king's intereſt, Mr Ludlow joined with the ſame party, and was preſent at the battle of Edgehill as a volunteer under the earl of Eſſex. Upon the death of his father, he was choſen knight of the ſhire for Wilts, and obtained the command of a regiment of horſe for the defence of that county. He was one of King Cha. I.'s judges: after whoſe death he was ſent by the parliament into Ireland, in quality of lieutenant-general of the horſe; which employment he diſcharged with diligence and ſucceſs till the death of the lord-deputy Ireton, when he acted for ſome time as general, though without that title; Cromwell, who knew him to be ſincerely in the intereſt of the commonwealth, always finding out ſome pretext to hinder the conferring of that character upon him. The laſt ſtroke had been given

Ludlow. given by Ludlow to the Iriſh rebellion, if the uſurpation of Cromwell had not prevented it. Under his power he never acted; and though Cromwell uſed his utmoſt efforts, he remained inflexible. After Cromwell's death, he endeavoured to reſtore the commonwealth; but Charles II. being recalled, he thought proper to conceal himſelf, and eſcaped into Switzerland, where he ſettled. After the revolution, he came over into England, in order to be employed in Ireland againſt King James: but appearing publicly in London, it gave great offence; and an addreſs was preſented by Sir Edward Seymour to King William III. for a proclamation in order to apprehend Colonel Ludlow, attainted for the murder of King Charles I. Upon this he returned to Switzerland, where he died. During his retirement in Switzerland he wrote his Memoirs.

Ludlow, a town of Shropſhire in England, ſituated at the conflux of the Teme and Corve, 18 miles from Shrewſbury, and 138 from London. The preſident of the council of the marches, eſtabliſhed by Henry VIII. generally kept his courts in it, by which the town was much benefited, theſe courts not having been aboliſhed till the 1ſt of William and Mary. Its neighbourhood to Wales makes it a great thoroughfare, and engages many of the Welch to ſend their children of both ſexes to it for education. It was incorporated by Edward IV. and among other privileges has that of trying and executing criminals within itſelf. It is one of the neateſt towns in England, with walls and ſeven gates. It is divided into four wards; and is governed by 2 bailiffs, 12 aldermen, 25 common-councilmen, a recorder, a town-clerk, ſteward, chamberlain, coroner, &c. From the caſtle on the top of the hill on which the town ſtands is a moſt delightful proſpect. In an apartment of the outer gatehouſe Samuel Butler is ſaid to have written the firſt part of Hudibras. Of this caſtle, which was beſieged and taken by King Stephen, ſome of the offices are fallen down, and great part of it turned into a bowling-green; but part of the royal apartments and the ſword of ſtate are ſtill left. The walls were at firſt a mile in compaſs, and there was a lawn before it for near two miles, of which much is now incloſed. The battlements are very high and thick, and adorned with towers. It has a neat chapel, where are the coats of arms of abundance of Welch gentry, and over the ſtable-doors are the arms of Queen Elizabeth, the earls of Pembroke, &c. This caſtle was a palace of the prince of Wales, in right of his principality. The river Teme has a good bridge over it, ſeveral wears acroſs it, and turns a great many mills. Here is a large parochial church, which was formerly collegiate; in the choir whereof is an inſcription relating to Prince Arthur, elder brother to King Henry VIII. who died here, and whoſe bowels were here depoſited, though it is ſaid his heart was taken up ſome time ago in a leaden box. In this choir is a cloſet, commonly called *God's Houſe*, where the prieſts uſed to keep their conſecrated utenſils; and in the market-place is a conduit, with a long ſtone croſs on it, and a niche wherein is the image of St Laurence, to whom the church was dedicated. On the north ſide of the town there was a rich priory, whereof there are few ruins to be ſeen except thoſe of its church. Here are an alms-houſe for 30 poor people, and two charity-ſchools where 50 boys and 30 girls are both taught and clothed. It has a market on Monday, and three leſſer ones on Wedneſday, Friday, and Saturday. Its fairs are on the Tueſday Eaſter, Whit-Wedneſday, Auguſt 21. Sept. 28. and Dec. 8. Proviſions are very cheap here; and at the annual horſe-races there is the beſt of company. The country round is exceedingly pleaſant, fruitful, and populous, eſpecially that part called the *Corveſdale*, being the vale on the banks of the river Corve. Ludlow ſends two members to parliament.

Ludolph || Luff.

LUDOLPH (Job), a very learned writer of the 17th century, was born at Erfurt in Thuringia. He travelled much, and was maſter of 25 languages; viſited libraries, ſearched after natural curioſities and antiquities every where, and converſed with learned men of all nations. He publiſhed A Hiſtory of Ethiopia, and other curious books.

Ludolph (Henry William), nephew of Job above-mentioned, was born at Erfurt in 1655. He came over to England as ſecretary to M. Lenthe, envoy from the court of Copenhagen to that of London; and being recommended to Prince George of Denmark, was received as his ſecretary. He enjoyed this office for ſome years, until he was incapacitated by a violent diſorder; when he was diſcharged with a handſome penſion: after he recovered, he travelled into Muſcovy, where he was well received by the czar, and where his knowledge made the Muſcovite prieſts ſuppoſe him to be a conjuror. On his return to London in 1694, he was cut for the ſtone; and as ſoon as his health would permit, in acknowledgment of the civilities he had received in Muſcovy, he wrote a grammar of their language, that the natives might learn their own tongue in a regular method. He then travelled into the Eaſt, to inform himſelf of the ſtate of the Chriſtian church in the Levant; the deplorable condition of which induced him, after his return, with the aid of the biſhop of Worceſter, to print an edition of the New Teſtament in the vulgar Greek, to preſent to the Greek church. In 1709, when ſuch numbers of Palatines came over to England, Mr Ludolph was appointed by Queen Anne one of the commiſſioners to manage the charities raiſed for them; and he died early the following year. His collected works were publiſhed in 1712.

LUDWIDGIA, in botany: A genus of the monogynia order, belonging to the tetrandria claſs of plants; and in the natural method ranking under the 17th order, *Calycanthemæ*. The corolla is tetrapetalous; the calyx quadripartite, ſuperior; the capſule tetragonal, quadrilocular, inferior, and polyſpermous.

LUES, among phyſicians, is in general uſed for a diſeaſe of any kind; but in a more particular ſenſe is reſtrained to contagious and peſtilential diſeaſes: thus the *lues Gallica*, or *venerea*, ſignifies the venereal diſeaſe. See Medicine-*Index*.

LUFF, the order from the pilot to the ſteerſman to put the helm towards the *lee*-ſide of the ſhip, in order to make the ſhip ſail nearer the direction of the wind. Hence, luff round, or luff a-lee, is the exceſs of this movement, by which it is intended to throw the ſhip's head up in the wind, in order to tack her, &c. A ſhip is accordingly ſaid to ſpring her luff when ſhe yields to the effort of the helm, by ſailing

Luff || Luke.

nearer to the line of the wind than ſhe had done before. See alſo *Hauling the Wind.*

Luff-Tackle, a name given by ſailors to any large tackle that is not deſtined for a particular place, but may be variouſly employed as occaſion requires. It is generally ſomewhat larger than the jigger tackle, although ſmaller than thoſe which ſerve to hoiſt the heavier materials into and out of the veſſel, which latter are the main and fore-tackles, the ſtay and quarter-tackles, &c.

LUG-SAIL, a ſquare-ſail, hoiſted occaſionally on the maſt of a boat or ſmall veſſel upon a yard which hangs nearly at right angles with the maſt. Theſe are more particularly uſed in the barca longas, navigated by the Spaniards in the Mediterranean.

LUGDUNUM (anc. geog.), the capital of the Seguſiani in Gallia Celtica, ſituated at the conflux of the Arar and Rhodanus, on an eminence, as the Celtic term *dune* ſignifies; built by Manutius Planeus under Auguſtus, while commanding in that part of Gaul; and whither he led a colony. Now *Lyons*, capital of the Lyonois.

Lugdunum Batavorum (anc. geog), a town of the Batavi in Gallia Belgica. Now *Leyden* in Holland.

Lugdunum Converarum (anc. geog.), a town of Gaul in Aquitain, at the foot of the Pyrenees. Now *S. Bertrand*, in Gaſcony.

LUGEUS LACUS (anc. geog.), a lake of Japydia, the weſtmoſt diſtrict of Illyricum, to the ſouth of the Save, and near the head of the Arſia. Now commonly called the *Zirichnitz Lake*, from a ſmall adjoining town. It is locked on every ſide with mountains; from which ſcanty currents run down; the leſs in quantity their waters, becauſe drank up by the earth; till at length they are ſwallowed up in rocky furrows, ſo formed as to reſemble artificial. In theſe the water being ſo redundant as to refuſe receiving any more, they regurgitate, and return the water with extraordinary celerity; which thus ſpreading itſelf, forms a lake, in moſt places 18 cubits high. Theſe waters afterwards retire with no leſs celerity than they came on, not only through the furrows, but paſs through the whole of the bottom, as through a ſieve; which when perceived by the inhabitants, they directly ſtop up the larger apertures, and thus take large quantities of fiſh: when the lake is dry, they cut down their harveſt on the ſpot where they ſowed, and ſow again before the inundation comes on: and graſs ſhoots ſo quick on it, that it may be cut down in three weeks time (Lazius, Wernherus).

LUGGERSHALL, a borough of Wiltſhire, 12 miles north of Saliſbury, and 75 north by weſt of London. It is an ancient borough by preſcription, though but a ſmall hamlet, near the foreſt of Chute, in a delightful country; and was the reſidence of ſeveral kings. It had formerly a caſtle. It is governed by a bailiff choſen yearly at the lord of the manor's court-leet. On the neighbouring downs there uſed to be horſe-races. It has a fair on the 25th of July, and ſends two members to parliament.

LUKE (St), the evangeliſt, and the diſciple of the apoſtles, was originally of Antioch in Syria, and by profeſſion a phyſician. He particularly attached himſelf to St Paul, and was his faithful companion in his travels and labours. He went with him to Troas in Macedonia about the year 51. He wrote his Goſpel in Achaia about the year 53; and, ten years after, the Acts of the Apoſtles, which contains a hiſtory of 30 years. Of all the inſpired writers of the New Teſtament, his works are written in the moſt elegant Greek. It is believed that St Luke died at Rome, or in Achaia.

Luke || Lumbricus

Goſpel of St Luke, a canonical book of the New Teſtament. Some think that it was properly St Paul's Goſpel; and that, when the apoſtle ſpeaks of *his* Goſpel, he means what is called *St Luke*'s. Irenæus ſays, that St Luke digeſted into writing what St Paul preached to the Gentiles; and Gregory Nazianzen tells us, that St Luke wrote with the aſſiſtance of St Paul.

St Luke the Evangeliſt's Day, a feſtival in the Chriſtian church, obſerved on the 18th of October.

LULA, a town of Swediſh Lapland; ſeated at the mouth of the river Lula, on the weſt ſide of the gulph of Bothnia, 42 miles ſouth-weſt of Tornea. E. Long. 21. 0. N. Lat. 64. 30.

Lula Lapmark, a province of Swediſh Lapland; bounded by that of Tornea on the north, by the Bothnic Gulph on the eaſt, by Pithia Lapmark on the ſouth, and Norway on the weſt.

LULLI (John Baptiſt), the moſt celebrated and moſt excellent muſician that has appeared in France ſince the revival of learning, was born at Florence. He was taken to France when very young by a perſon of quality; and he carried the art of playing on the violin to the higheſt perfection. Louis XIV. made him ſuperintendant of muſic. Some time after Perinna having introduced operas into France, and quarrelling with his company, he reſigned his privilege to Lulli. Operas were then carried to the utmoſt perfection by this celebrated muſician, and were attended with continual applauſe. Lulli every year, after this time, gave a piece of his own compoſition, till his death, which happened in 1687.

LULLY (Raymond), a famous writer, ſurnamed the *Enlightened Doctor*, was born in the iſland of Majorca in 1225. He applied himſelf with indefatigable labour to the ſtudy of the Arabian philoſophy, to chemiſtry, phyſic, and divinity; and acquired great reputation by his works. He at length went to preach the goſpel in Africa; and was ſtoned to death in Mauritania, at the age of 80. He is honoured as a martyr at Majorca, whither his body was carried. He wrote many treatiſes on all the ſciences, in which he ſhows much ſtudy and ſubtilty, but little judgment or ſolidity. A complete edition of his works has been printed at Mentz.—He ought not to be confounded with Raymond Lully of Terraca, ſurnamed *Neophyta*, who from being a Jew turned Dominican friar. This laſt Lully maintained ſeveral opinions that were condemned by Pope Gregory XI.

LUMBAGO, a fixed pain in the ſmall of the back. See MEDICINE-*Index*.

LUMBARIS, a name given to the arteries and veins which ſpread over the loins.

LUMBRICAL, a name given to four muſcles of the fingers and to as many of the toes.

LUMBRICUS, the WORM, in zoology; a genus of inſects belonging to the order of vermes inteſtina. The body is cylindrical, annulated, with an elevated belt near the middle, and a vent-hole on its ſide. There are two ſpecies of this animal.

Lumbricus || Luminous.

1. Lumbricus terreſtris, the earth or dew worm, Mr Barbut obſerves, differs extremely in colour and external appearance in the different periods of its growth, which has occaſioned people little acquainted with the variations of this kind of animals to make four or five different ſpecies of them: The general colour is a duſky red.—They live under ground, never quitting the earth but after heavy rains or at the approach of ſtorms, and in the ſeaſon of their amours. The method to force them out is, either to water the ground with infuſions of bitter plants, or to trample on it. The bare motion on the ſurface of the ſoil drives them up, in fear of being ſurpriſed by their formidable enemy the mole. The winding progreſſion of the worm is facilitated by the inequalities of its body, armed with ſmall, ſtiff, ſharp-pointed briſtles: when it means to inſinuate itſelf into the earth, there oozes from its body a clammy liquor, by means of which it ſlides down. It never damages the roots of vegetables. Its food is a ſmall portion of earth, which it has the faculty of digeſting: The ſuperfluity is ejected by way of excrement, under a vermicular appearance. Earth-worms are hermaphrodites, and have the parts of generation placed near the neck: their copulation is performed on the ground; nothing being more uſual than to ſee it full of holes, which holes are thought to be made by thoſe kind of worms coming to the ſurface in queſt of females. During their coition they would ſooner ſuffer themſelves to be cruſhed than parted.

Plate CCLXXIV

2. The marinus, marine worm, or lug, is of a pale red colour, and the body is compoſed of a number of annular joints; the ſkin is ſcabrous, and all the rings or joints are covered with little prominences, which render it extremely rough to the touch. It is an inhabitant of the mud about the ſea ſhores, and ſerves for food to many kinds of fiſh: ſurpriſing large ones are to be met with about the Bognor rocks in Suſſex. The fiſhermen bait their hooks and nets with it.

For the effects of theſe animals in the human body, and the method of expelling them, ſee MEDICINE-*Index*.

LUMELLO, a village in Italy, which gives name to the Lumellin, a ſmall diſtrict in the duchy of Milan, lying along the river Po, and of which Mortaria and Valencia are the principal places. It was ceded to the duke of Savoy in 1707, and confirmed by the treaty of Utrecht in 1713. E. Long. 8. 42. N. Lat. 45. 5.

LUMINOUS, an epithet applied to any thing that ſhines or emits light.

Luminous Emanations, have been obſerved from human bodies, as alſo from thoſe of brutes. The light ariſing from currying a horſe, or from rubbing a cat's back, are known to moſt Inſtances of a like kind have been known on combing a woman's head. Bartholin gives us an account, which he intitles *mulier ſplendens*, of a lady in Italy whoſe body would ſhine whenever ſlightly touched with a piece of linen. Theſe effluvia of animal bodies have many properties in common with thoſe produced from glaſs; ſuch as their being lucid, their ſnapping, and their not being excited without ſome degree of friction; and are undoubtedly electrical, as a cat's back has been found ſtrongly electrical when ſtroaked. See ELECTRICITY, and LIGHT.

LUMINOUSNESS OF THE SEA. See LIGHT, and SEA.

Luminouſneſs of Putreſcent Subſtances. See LIGHT.

LUMP-FISH. See CYCLOPTERUS.

Luminouſneſs || Lunarium.

LUNA (anc. geog.), a foreſt of Germany, at no great diſtance from the Hercynia; below which were the Boemi: it was therefore in Moravia, near the ſprings of the Marus, now March, which runs into the Danube over againſt Carnutum.

LUNA, or *Lunna*, a town of Gallia Celtica. Now *Clugny* in Burgundy.

LUNA, a town and port of Liguria, at the mouth of the Macra. The town was but ſmall, but the port large and beautiful, according to Strabo. Now extinct, and its ruins called *Luna Diſtrutta*. It was famous for its quarries of white marble, thence called *Lunenſe*; and for its cheeſe, remarkable rather for its ſize than goodneſs, each being a thouſand weight.

LUNA, in aſtronomy, the moon. See ASTRONOMY, *paſſim*.

LUNA, in the jargon of the alchemiſts, ſignifies *ſilver*; ſo called from the ſuppoſed influence of the moon thereupon.

Luna Cornea, in chemiſtry, is the combination of marine acid with ſilver. See CHEMISTRY-*Index*.

LUNACY, a ſpecies of madneſs. See LUNATIC, and MEDICINE-*Index*.

LUNACY, in law. See IDIOCY, and LUNATIC.

LUNÆ MONS (anc. geog.), a promontory of Luſitania. Now *Rock of Liſbon*. W. Long. 10. N. Lat. 38. 50.—Another *Lunæ Mons* of Ethiopia, from which the Nile was ſuppoſed to take its riſe.

Lunæ Portus, a very extenſive port, or more truly a bay, of Liguria, between Portus Veneris and Portus Ericis, 20 miles in compaſs. Now *il Golfo della Spezia*, on the eaſt coaſt of the territory of Genoa.

LUNAR, ſomething relating to the MOON.

Lunar Month. See MONTH.

Lunar Year, conſiſts of 354 days, or 12 ſynodical months. See YEAR.

Lunar Dial. See DIALLING.

LUNARE os, in anatomy, is the ſecond bone in the firſt row of the carpus. It has its name from the Latin, *luna* "the moon," becauſe one of its ſides is in form of a creſcent.

LUNARIA, SATTIN-FLOWER, or *Moonwort*, in botany: A genus of the ſiliculoſa order, belonging to the tetradynamia claſs of plants; and in the natural method ranking under the 39th order, *Siliquoſæ*. The ſilicula is entire, elliptical, compreſſed-plane, and pedicellated; with the valves equal to the partition, parallel and plane; the leaves of the calyx are alternately fritted at the baſe. This plant is famous in ſome parts of the kingdom for its medicinal virtues, though it has not the fortune to be received in the ſhops. The people in the northern countries dry the whole plant in an oven, and give as much as will lie on a ſhilling for a doſe twice a-day in hemorrhages of all kinds, particularly in the too abundant flowing of the menſes, and with great ſucceſs. The Welch, among whom it is not uncommon, Dr Needham informs us, make an ointment of it, which they uſe externally, and pretend it cures dyſenteries.

LUNARIUM (anc. geog.), a promontory of the Hither Spain, between Blanda and Bætulo. Com-

Lunatic. monly called *el Cabo de Palafugel*, in Catalonia, on the Mediterranean; or *Cabo de Toſa*, on the ſame coaſt, and in Catalonia, 15 miles from the former, to the weſt.

LUNATIC, a perſon affected with that ſpecies of madneſs termed *lunacy*. The word is indeed properly applied to one that hath lucid intervals; ſometimes enjoying his ſenſes, and ſometimes not; and that frequently ſuppoſed to depend on the influence of the moon.

LUNATIC, in law. Under the general term of *non compos mentis* (which Sir Edward Coke ſays is the moſt legal name) are comprized not only lunatics, but perſons under frenzies, or who loſe their intellects by diſeaſe; thoſe that *grow* deaf, dumb, and blind, not being *born* ſo; or ſuch, in ſhort, as are judged by the court of chancery incapable of conducting their own affairs. To theſe alſo, as well as idiots, the king is guardian, but to a very different purpoſe. For the law always imagines, that theſe accidental misfortunes may be removed; and therefore only conſtitutes the crown a truſtee for the unfortunate perſons, to protect their property, and to account to them for all profits received, if they recover, or after their deceaſe to their repreſentatives. And therefore it is declared by the ſtatute 17 Edw. II. c. 10. that the king ſhall provide for the cuſtody and ſuſtentation of lunatics, and preſerve their lands, and the profits of them, for their uſe when they come to their right mind; and the king ſhall take nothing to his own uſe: and if the parties die in ſuch eſtate, the reſidue ſhall be diſtributed for their ſouls by the advice of the ordinary, and of courſe (by the ſubſequent amendments of the law of adminiſtrations) ſhall now go to their executors or adminiſtrators.

On the firſt attack of lunacy, or other occaſional inſanity, when there may be hopes of a ſpeedy reſtitution of reaſon, it is uſual to confine the unhappy objects in private cuſtody under the direction of their neareſt friends and relations: and the legiſlature, to prevent all abuſes incident to ſuch private cuſtody, hath thought proper to interpoſe its authority, by 14. Geo. III. c. 49. for regulating private mad-houſes. But when the diſorder is grown permanent, and the circumſtances of the party will bear ſuch additional expence, it is thought proper to apply to the royal authority to warrant a laſting confinement.

The method of proving a perſon *non compos* is very ſimilar to that of proving him an idiot. The lord chancellor, to whom, by ſpecial authority from the king, the cuſtody of idiots and lunatics is intruſted, upon petition or information, grants a commiſſion in nature of the writ *de idiota inquirendo*, to inquire into the party's ſtate of mind; and if he be found *non compos*, he uſually commits the care of his perſon, with a ſuitable allowance for his maintenance, to ſome friend, who is then called his committee. However, to prevent ſiniſter practices, the next heir is ſeldom permitted to be of this committee of the perſon; becauſe it is his intereſt that the party ſhould die. But, it hath been ſaid, there lies not the ſame objection againſt his next of kin, provided he be not his heir; for it is his intereſt to preſerve the lunatic's life, in order to increaſe the perſonal eſtate by ſavings, which he or his family may hereafter be entitled to enjoy. The heir is generally made the manager or committee of the eſtate, it being clearly his intereſt by good management to keep it in condition: accountable, however, to the court of chancery, and to the *non compos* himſelf, if he recovers; or otherwiſe, to his adminiſtrators. See IDIOCY. Lunation || Lunenburg

LUNATION, the period or ſpace of time been one new moon and another; alſo called *ſynodical month*. See CYCLE and EPACT.

LUNDEN, or LUND, a conſiderable town of Sweden, in Gothland; and capital of the territory of Schonen, with an archbiſhop's ſee and an univerſity. It was ceded to the Swedes by the Danes in 1658. E. Long. 13. 25. N. Lat. 55. 40.

LUNDY ISLAND, ſituated 50 miles in the ſea, off the N. W. coaſt of Devonſhire, is 5 miles long and 2 broad, but ſo encompaſſed with inacceſſible rocks, that it has but one entrance to it, ſo narrow that two men can ſcarce go abreaſt. It is reckoned in the hundred of Branton. It had once both a fort and a chapel. The ſouth part of it is indifferent good ſoil, but the north part of it is barren, and has a high pyramidical rock called the Conſtable. Here are horſes, kine, hogs, and goats, with great ſtore of ſheep and rabbits; but the chief commodity is fowl, with which it abounds much, their eggs being very thick on the ground at their ſeaſon of breeding. No venomous creature will live in this iſland. In the reign of King Henry VIII. one William Moriſco, who had conſpired to murder him at Woodſtock, fled to this iſland, which he fortified, turned pirate, and did much damage to this coaſt, but was taken by ſurprize at length, with 16 of his accomplices, and put to death.

LUNE, LUNULA, in *Geometry*, a plane in form of a creſcent or half-moon, terminated by the circumference of two circles, that interſect each other within.

LUNENBURG, or LUNEBURG *Zell*, a principality of Germany, bounded to the ſouth by that of Calenberg, the dioceſe of Hildeſheim, and the duchy of Brunſwic; to the north, by the duchy of Lauenburg and the Elbe, by the laſt of which it is ſeparated from the territory of the imperial city of Hamburg; to the eaſt, by the duchy of Brunſwic, the Alte Mark, and the duchy of Mecklenburg; and to the weſt, by the duchies of Bremen and Verden, the county of Hoya, and the principality of Calenberg. The ſoil, except along the Elbe, Aller, and Jetz, is either ſand, heath, or moors. In the more fruitful parts of it are produced wheat, rye, barley, oats, peaſe, buck wheat, flax, hemp, hops, pulſe, oak, beech, firs, pines, birch, and alder, together with black cattle and horſe. The heaths abound with bees and honey, and a ſmall kind of ſheep whoſe wool is long and courſe. Lunenburg is well furniſhed with ſalt ſprings and limeſtone, and the foreſt of Gorde with veniſon. The rivers Elbe, Ilmenau, and Aller, are navigable; and conſequently very advantageous to the country, independent of the fiſh which they yield. The general diets of this principality are convened by the ſovereign twice a year, and held at Zell. They conſiſt of the deputies of the nobility and the towns of Lunenburg, Uelzen, and Zell, who have the nomination of the members of the high colleges, and other officers, jointly with the ſove-

Lunenburg

reign. There are near 200 Lutheran churches in the country, under two general and 15 ſubordinate ſuperintendants, ſeveral grammar-ſchools, two Calviniſt churches at Zell, and an academy of exerciſes at Lunenburg. The manufactures are chiefly linen cloth, cottons, ribbons, ſtockings, hats, ſtarch, bleached wax, refined ſugar, gold and ſilver wires, all kinds of wooden wares, barges, boats, and ſhips. The exports of theſe to Hamburg, Lubec, and Altena, are conſiderable. The neighbourhood of theſe cities, with the facility of conveying goods and merchandize to them and other places, either by land or water, is very advantageous to this country, and contributes greatly to its ſubſiſtence. On account of this principality, the king of Great Britain has a ſeat and voice both in the college of the princes of the empire and of the circle of Lower Saxony. Its quota in the Matricula is 20 horſes and 120 foot, or 720 florins in lieu of them. The revenues of the principality ariſe chiefly from the demeſnes, tolls on the Elbe, contributions, duties on cattle, beer, wine, brandy, and other commodities, which all together muſt be very conſiderable, ſome bailiwics alone yielding upwards of 20,000 rix-dollars.

LUNENBURG, the capital of the principality of the ſame name, is a pretty large town of Germany, on the river Elmen, or the Ilmenau, which is navigable from the town to the Elbe, at the diſtance of 13 miles. It is 27 miles from Hamburgh, 43 from Zell, 65 from Brunſwic, 76 from Bremen, 68 from Hanover; and ſtands in E. Long. 10. 40. N. Lat. 53. 28. Its inhabitants are reckoned at between 8000 and 9000. Formerly this town was one of the Hanſe, and an imperial city. Some derive its name from *Lina*, the ancient name of the Ilmenau; others from *Luna*, the moon, an image of which is ſaid to have been worſhipped by the inhabitants in the times of Paganiſm. Here were anciently ſeveral convents, viz. one of Minims, another of Premonſtratenſians, another of Benedictines, and a fourth of Minorites. Out of the revenues of the Benedictine monaſtery was founded an academy for the martial exerciſes, where young gentlemen of the principality of Lunenburg are maintained gratis, and taught French, fencing, riding, and dancing; but foreigners are educated at a certain fixed price. A Latin ſchool was alſo founded, conſiſting of four claſſes, and well endowed out of theſe revenues. The ſuperintendency and management of theſe, and the eſtates appropriated to their maintenance, belongs to the landſchaft director, and the auſreiter, who are both choſen from among the Luneburg nobility. The firſt came in place of the Popiſh abbot, and as ſuch is head of the ſtates of the principality, and preſident of the provincial college. He has the title of *excellency*; and in public inſtruments ſtyles himſelf, *by the grace of God landſchaft director*, and *lord of the manſion of St Michael in Luneburg*. The chief public edifices are three pariſh-churches, the ducal palace, three hoſpitals, the town-houſe, the ſalt-magazine, the anatomical theatre, the academy; the conventual church of St Michael, in which lie interred the ancient dukes; and in which is the famous table eight feet long, and four wide, plated over with chaſed gold, with a rim embelliſhed with precious ſtones, of an immenſe value, which was taken from the Saracens by the emperor Otho, and preſented to this church; but in 1698, a gang of thieves ſtripped it of 200 rubies and emeralds, together with a large diamond, and moſt of the gold, ſo that at preſent but a ſmall part of it remains. Here are ſome very rich ſalt-ſprings. Formerly, when there was a greater demand for the ſalt, upwards of 120,000 tons have been annually boiled here, and ſold off: but ſince the commencement of the preſent century, the ſalt trade hath declined greatly. A fifth of the ſalt made here belongs to the king, but is farmed out. It is ſaid to excel all the other ſalt made in Germany. This town is well fortified; and has a garriſon, which is lodged in barracks. In the neighbourhood is a good lime-ſtone quarry; and along the Ilmenau are ware-houſes, in which are lodged goods brought from all parts of Germany, to be forwarded by the Elmenau to Hamburg, or by the Aſche to Lubec, from whence other goods are brought back the ſame way. The town itſelf drives a conſiderable traffic in wax, honey, wool, flax, linen, ſalt, lime, and beer.

Lunenſe
||
Lungs.

LUNENSE MARMOR, in the natural hiſtory of the ancients, the name of that ſpecies of white marble now known among us by the name of the *Carrara-marble*, and diſtinguiſhed from the ſtatuary kind by its greater hardneſs and leſs ſplendour. It was ever greatly eſteemed in building and ornamental works, and is ſo ſtill. It is of a very cloſe and fine texture, of a very pure white, and much more tranſparent than any other of the white marbles. It has always been found in great quantities in Italy, and is ſo to this day. See LUNA.

LUNETTE, in fortification, an enveloped counter-guard, or elevation of earth, made beyond the ſecond ditch, oppoſite to the places of arms; differing from the ravelins only in their ſituation. *Lunettes* are uſually made in ditches full of water, and ſerve to the ſame purpoſe as fauſſebrays, to diſpute the paſſage of the ditch. See FORTIFICATION.

LUNETTE, in the manege, is a half horſe-ſhoe, or ſuch a ſhoe as wants the ſpunge, *i. e.* that part of the branch which runs towards the quarters of the foot.

LUNETTE is alſo the name of two ſmall pieces of felt, made round and hollow, to clap upon the eyes of a vicious horſe that is apt to bite, and ſtrike with his fore feet, or that will not ſuffer his rider to mount him.

LUNGS, in anatomy, a part of the human body, ſerving for reſpiration. See ANATOMY, n° 117.

In the *Journal de Médicine* for June 1789 is a deſcription of an

Inſtrument for Inflating the LUNGS, invented by M. Gorcy phyſician to the military hoſpital at Neufbriſack, which appears to be exteremly well adapted to the purpoſe, whilſt it may be uſed with the greateſt eaſe and facility.

This inſtrument, which the inventor ſtyles *apodopic*, that is, "reſtorer of reſpiration," conſiſts of a double pair of bellows, BCLM, fig. 1, the two different parts of which have no communication with each other. In the lower ſide B M, is an aperture A. for a valve conſtructed on the principles of thoſe of Mr Nairne's air-pump. It conſiſts of a rim of copper, cloſed at one end by a plate of the ſame metal, in which plate are ſeven ſmall holes placed at equal diſtances. This plate

Plate CCLXXV

is

Lungs, Lunisolar.

is covered with a piece of silk coated with elastic gum, in which are six transverse incisions of two or three lines in length. Each incision is so made as to be situated between two of the holes, and at an equal distance from each: *see* D, fig. 2. The silk must be made very secure, by a thread passing several times round the rim. It is obvious, that a stream of air applied to that side of the plate which is opposite the silk, will pass through the holes, and, lifting up the silk, escape through the incisions. On the contrary, a stream of air applied to the other side will press the silk upon the plate, and thus close the holes, so that it will be impossible for it to pass through them. This valve opens internally, so as to admit the air from without. At B is another valve, on the same construction, but opening in a contrary direction, thus permitting the air to escape out of the lower part into the tube E F; but preventing its entrance. At C is another valve, opening internally to admit the air from the tube E F; and at D there is a fourth, opening externally, to discharge the air from the upper part.

The flexible tube E F, screwed on at the end C B, being introduced into one of the nostrils, whilst the mouth and the other nostril are closed by an assistant, if we separate the two handles L M, which were close together at the introduction of the tube, it is evident, that the air in the lungs will rush into the upper part through the valve C, whilst the external air will fill the lower part through the valve A: the two handles being again brought into contact, the atmospheric air will be forced into the lungs through the valve B, and at the same time the air in the upper part will be discharged at the valve D. Thus by the alternate play of the double bellows, the lungs will be alternately filled and emptied as in respiration. In using the instrument care should be taken not to be too violent; as the more perfectly the natural motion of respiration is imitated the better.

To prevent any substances from without injuring the valves A, D, fig. 1, the rim is made with a screw, B, fig. 3, in order to receive a cap A A, fig. 3, full of small holes. This screw has also another use. If dephlogisticated air be preferred, a bladder filled with it, fig. 4, may, by means of the screw A, be fastened to the valve A, fig. 1; and, to prevent waste, as this air may serve several times, a flexible tube may be screwed on the valve D, fig. 1. communicating with the bladder by means of the opening *d*, fig. 4: thus it may be employed as often as the operator thinks proper.

There is a handle K to the partition in the middle, in order that, if it be at any time necessary to use either of the divisions alone, the other may be confined from acting. *c*, *b*, fig. 5, represent the two valves to be applied at the end of the instrument C, B, fig. 1; and fig. 6. is a section of the end C B, showing the valves in their proper places.

It is proper to add, that the capacity of the instrument should be proportioned to the quantity of air received into the lungs in inspiration, which Dr Goodwyn has ascertained to be twelve cubical inches or somewhat more. Each division of the instrument, therefore, should be capable of containing that quantity.

Lung-Wort, in botany. See PULMONARIA.

LUNISOLAR YEAR, in chronology, the space of 532 common years; found by multiplying the cycle of the sun by that of the moon.

Lunula & Lupus.

LUNULA. See LUNE.

LUPERCALIA, feasts instituted in ancient Rome, in honour of the god Pan.—The word comes from *Lupercal*, the name of a place under the Palatine mountain, where the sacrifices were performed.

The Lupercalia were celebrated on the 15th of the kalends of March, that is, on the 15th of February, or, as Ovid observes, on the third day after the ides. They are supposed to have been established by Evander.

On the morning of this feast, the Luperci, or priests of Pan, ran naked through the streets of Rome, striking the married women they met on the hands and belly with a thong or strap of goat's leather, which was held an omen promising them fecundity and happy deliveries. See LUPERCI.

This feast was abolished in the time of Augustus; but afterwards restored, and continued to the time of the emperor Anastasius.—Baronius says it was abolished by the pope in 496.

LUPERCI, a name given to the priests of the god Pan. See LUPERCALIA.

The *luperci* were the most ancient order of priests in Rome; they were divided into two colleges or companies, the one called *Fabii* and the other *Quintilii*. To these Cæsar added a third, which he called *Julii*.

LUPINUS, LUPINE, in botany: A genus of the decandria order, belonging to the diadelphia class of plants; and in the natural method ranking under the 32d order, *Papilionaceæ*. The calyx is bilabiated; there are five oblong and five roundish antheræ; the legumen is coriaceous. There are seven species, six of them hardy herbaceous flowery annuals, and one perennial, rising with upright stalks from one to three or four feet high, ornamented with digitate or fingered leaves, and terminated by long whorled spikes of papilionaceous flowers, white, blue, yellow, and rose-coloured. They are all easily raised from seed; and succeed in any open borders, where they make a fine variety.

The seeds of the white lupine, which have a leguminous taste accompanied with a disagreeable bitter one, are said to be anthelmintic, both internally taken, and applied externally. Caspar Hoffman cautions against their external use, and tells us (from one of the Arabian writers) that they have sometimes occasioned death. Simon Pauli also says, that he saw a boy of eight or ten years of age, after taking a dram of these seeds in powder, seized with exquisite pains in the abdomen, a difficulty of respiration, and almost total loss of voice; and that he was relieved from these complaints by a glyster of milk and sugar, which brought away a vast quantity of worms. But Mr Geoffroy observes, very justly, that either these symptoms were owing to the worms, and not to the medicine; or that these seeds, if they have any noxious quality, lose it with their bitterness in boiling; since they were commonly used among the Greeks as food, and recommended by Galen as very wholesome.

LUPULUS, in botany. See HUMULUS.

LUPUS, in zoology. See CANIS.

Lupus-Marinus. See ANARRHICHAS.

Lupus ‖ Luſatia.

LUPUS, in aſtronomy. See there, n° 406.

LURCHER, a kind of hunting-dog much like a mongrel gre-hound, with pricked ears, a ſhagged coat, and generally of a yelloviſh white colour: they are very ſwift runners, ſo that if they get between the burrows and the conies they ſeldom miſs; and this is their common practice in hunting: yet they uſe other ſubtilties, as the tumbler does, ſome of them bringing in their game, and thoſe are the beſt. It is alſo obſervable, that a lurcher will run down a hare at ſtretch.

LURE, in falconry, a device of leather, in the ſhape of two wings, ſtuck with feathers, and baited with a piece of fleſh, to call back a hawk when at conſiderable diſtance.

LURGAN, a poſt and fair town in the county of Armagh and province of Ulſter in Ireland, 67 miles from Dublin. It is a flouriſhing town, agreeably ſituated in the midſt of a much improved country; and the inhabitants are extenſively engaged in the linen manufacture. It ſtands on a gentle eminence, about two miles from Lough Neagh, of which it commands a moſt beautiful and extenſive proſpect. The fairs are three in the year. N. Lat. 54. 35. W. Long. 6. 31.

LURGAN-GREEN, a poſt and fair town of Ireland, in the county of Louth and province of Leinſter, 37 miles from Dublin; a mile beyond which is a handſome ſeat of the earl of Charlemont. It has three fairs in the year.

LURIDÆ, the name of the 28th order in Linnæus's fragments of a natural method. See BOTANY, p. 462.

LUSATIA, a marquiſate of Germany, in Upper Saxony; bounded to the eaſt by Sileſia, to the weſt by Miſnia, to the ſouth by Bohemia, and to the north by the marquiſate of Brandenburgh. Till towards the middle of the 15th century, the Upper Luſatia was called the *Mark*, i. e. *the marquiſate or the land of Budiſzin and Gorlitz;* and the Lower only *Luſatia*, which, it is ſaid, in the Sclavonic, ſignifies "a woody or marſhy country." The air of the Upper Luſatia, which is hilly or mountainous, is better than that of the Lower, a great part of which is mooriſh and boggy. Both abound in wood, eſpecially the Lower, and turf for fuel. The heathy and mountainous tracts are generally barren; but the lower champaign and marſh lands are tolerably fertile, producing paſture, wheat, rye, oats, barley, buck-wheat, peaſe, lentils, beans, and millet; together with flax, hops, tobacco, ſome white and red wine, and what is called *manna*. Of ſeveral of theſe articles, however, conſiderable quantities are imported. In this country are found alſo quarries of ſtone, medicinal ſprings, baſtard diamonds, agates, and jaſpers, earths and clays for tobacco-pipes and all ſorts of earthen ware, alum, good iron, ſtone, vitriolic and copper water; nor is it deſtitute of cattle, fiſh, and veniſon. The rivers Spree, the Schwarze or Black Elſter, and the Pulznitz, have their ſources in the Luſatias, which are alſo watered by the Neiſſe and Queis. The ancient inhabitants of this country were the Saxons, who were ſucceeded by the Vandals, and theſe by the Sober-Wends, a Sclavonian people. The preſent inhabitants, the deſcendants of the Wends, have an odd dreſs; and the language is ſo inarticulate and guttural, that it hath been ſaid, it might be pronounced without lips, teeth, or tongue: but the towns are almoſt wholly peopled by Germans. Luſatia.

In the Upper Luſatia are ſix towns which appear at the land-diets, 16 ſmaller country-towns, and four market towns. In the Lower are four diet-towns, 13 country-towns, and two market ones. Both marquiſates were formerly ſubject either to the kings of Bohemia, the archdukes of Auſtria, or electors of Brandenburgh; but, in 1636, both were abſolutely ceded to the elector of Saxony, in lieu of the 72 tons of gold which he expended in aſſiſting the emperor Ferdinand II. againſt the Bohemians.

Chriſtianity was firſt planted in Luſatia in the ſeventh century; but it was ſeveral centuries after that before Popery was fully eſtabliſhed. In the 11th century many cloiſters were erected in the country; but at the reformation ſuch numbers embraced Lutheraniſm, that it became the predominant religion, and ſtill continues, though there are ſtill ſeveral Roman Catholic foundations, churches, market-towns, and villages. The enthuſiaſtic ſect of Hernhuters poſſeſſes a great influence and eſteem here. There are conſiderable manufactures of woollen and linen ſtuffs in the Luſatias, eſpecially the Upper. At Budiſſen, and in the adjacent country, prodigious quantities of ſtockings, ſpatterdaſhes, caps, and gloves are made. The linen manufactures alſo flouriſh here, chiefly in the Upper Luſatia, where all ſorts of linen are made, printed, and dyed. Excluſive of theſe, there are conſiderable manufactures of hats, leather, paper, gunpowder, iron, glaſs, bleached wax, &c. Though the demand and exportation of theſe commodities, particularly linens and woollens, is not ſo great as formerly, yet it is ſtill conſiderable, and more than overbalances their importations in wool, yarn, ſilk, wines, ſpices, corn, freſh and baked fruits, garden ſtuff, and hops. Diſputes of many years ſtanding have ſubſiſted between the country-artificers and linen-manufacturers on the one ſide, and the diet-towns on the other; the latter unjuſtly ſeeking to exclude the former from any ſhare in the linen trade. The natives of this country are ſaid to have quick natural parts, but to be ſordidly penurious. We are told they obſerve the Saxon laws much better than they did the Bohemian. Learning hath been much eſteemed and encouraged in both marquiſates ſince the reformation. The ſchools in the ſix diet-towns of Upper Luſatia, particularly at Gorlitz, Budiſſen, and Zittau, greatly diſtinguiſh themſelves, having handſome ſtipends. In Lower Luſatia alſo are ſome good ſchools, with ſtipends for the maintenance of ſtudents. Printing is ſaid to be much followed, and brought to great perfection in this country.

In Upper Luſatia, the ſtates conſiſt, 1ſt, of thoſe called *ſtate-lords;* 2dly, of the prelates; 3dly, of the gentry and commonalty, under which are comprehended the counts, barons, nobles, and burgeſſes, poſſeſſors of fees and fief-eſtates; and, 4thly, of the repreſentatives of the ſix principal towns. Without the conſent of theſe ſtates no taxes can be impoſed, nor any thing of importance, that regards the public, tranſacted. The diets are ordinary or extraordinary. The ordinary meet once in three years, and the extraordinary when ſummoned by the ſovereign upon particular emergencies. As to eccleſiaſtical matters, the dean of

Bu-

Lufatia || Luſtral.

Budiſſen and his conſiſtory exerciſe all manner of epiſcopal juriſdiction; and, among the Proteſtants, the juriſdiction belongs either to the ſuperior, the upper-office, or the patrons. The revenues ariſing to the ſuperior or ſovereign, from Upper Luſatia, conſiſt partly of the ſubſidies granted by the ſtates, among which, at preſent, are reckoned capitation and eſtate-money; and partly of the beer-tax, exciſe, tolls, &c. —Upper Luſatia is divided into two great circles, viz. thoſe of Budiſſen and Gorlitz, which are again divided into leſſer circles.

The land-ſtates of Lower Luſatia conſiſt, like thoſe of the Upper, of prelates, lords, and knights, and the repreſentatives of the ſtate towns, which are Luckau, Gubben-Lubbin, and Kalau. Two land diets are yearly held at Lubben, called *voluntary-diets*; but when the ſuperior cauſes the ſtates to be ſummoned together at his diſcretion, and propoſitions to be laid before them, by commiſſaries deputed for that purpoſe, ſuch convention is called a *great land-diet*. The marquiſate is divided into five circles, each of which holds a circle-aſſembly in its circle-town. The chief officers appointed either by the ſuperior or the ſtates, are, the preſident of the upper-office, the land-captain, and the land-judge. The principal tribunals are, the land-court, and the upper-office, to which lie appeals from the inferior judicatories. There are alſo officers for the ſeveral circles. Spiritual matters belong here to a conſiſtory, erected in 1668. The ordinary taxes are paid into the cheſt of the circle; and from thence conſigned to the general cheſt, of which the upper tax-receiver is ſuperintendant. By him an annual account of the receipts is made out, which is examined and paſſed by the deputies of the ſtates.

LUSITANIA (anc. geog.), one of the diviſions of Spain, extending to the north of the Tagus, quite to the ſea of Cantabria, at leaſt to the Promontorium Celticum. But Auguſtus, by a new regulation, made the Anas its boundary to the ſouth, the Durius to the north; and thus conſtituting only a part of the modern Portugal. *Luſitani* the people, (Diodorus, Stephanus).

LUSTRAL, an epithet given by the ancients to the water uſed in their ceremonies to ſprinkle and purify the people. From them the Romaniſts have borrowed the holy water uſed in their churches.

Lustral Day, (Dies Luſtricus), that whereon the luſtrations were performed for a child, and its name given; which was uſually the ninth day from the birth of a boy, and the eighth from that of a girl. Tho' others performed the ceremony on the laſt day of that week wherein the child was born, and others on the fifth day from its birth.

Over this feaſt-day the goddeſs Nundina was ſuppoſed to preſide; the midwifes, nurſes, and domeſtics, handed the child backwards and forwards, around a fire burning on the altars of the gods, after which they ſprinkled it with water; hence this feaſt had the name of *amphidromia*. The old women mixed ſaliva and duſt with the water. The whole ended with a ſumptuous entertainment. The parents received gifts from their friends on this occaſion. If the child was a male, their door was decked with an olive garland; if a female, with wool, denoting the work about which women were to be employed.

LUSTRATION, in antiquity, ſacrifices or ceremonies by which the ancients purified their cities, fields, armies, or people, defiled by any crime or impurity. Some of theſe luſtrations were public, others private. There were three ſpecies or manners of performing luſtration, *viz.* by fire and ſulphur, by water, and by air; which laſt was done by fanning and agitating the air round the thing to be purified. Some of theſe luſtrations were neceſſary, *i. e.* could not be diſpenſed with; as luſtrations of houſes in time of a plague, or upon the death of any perſon: others again were done out of choice, and at pleaſure. The public luſtrations at Rome were celebrated every fifth year; in which they led a victim thrice round the place to be purified, and in the mean time burnt a great quantity of perfumes. Their country luſtrations, which they called *ambarvalia*, were celebrated before they began to reap their corn: in thoſe of the armies, which they called *armiluſtria*, ſome choſen ſoldiers, crowned with laurel, led the victims, which were a cow, a ſheep, and a bull, thrice round the army ranged in battle-array in the field of Mars, to which deity the victims were afterwards ſacrificed, after pouring out many imprecations upon the enemies of the Romans. The luſtrations of their flocks were performed in this manner: the ſhepherd ſprinkled them with pure water, and thrice ſurrounded his ſheepfold with a compoſition of ſavin, laurel, and brimſtone ſet on fire; and afterwards ſacrificed to the goddeſs Pales an offering of milk boiled, wine, a cake, and millet. As for private houſes, they were luſtrated with water, a fumigation of laurel, juniper, olive-tree, ſavin, and ſuch like; and the victim commonly was a pig. Luſtrations made for particular perſons were commonly called *expiations*, and the victims *piacula*. There was alſo a kind of luſtration uſed for infants, by which they were purified, girls the third, and boys the ninth, day after their birth; which ceremony was performed with pure water and ſpittle. See the article AMBARVALIA.—In their luſtratory ſacrifices, the Athenians ſacrificed two men, one for the men of their city, and the other for the women. Divers of theſe expiations were auſtere: ſome faſted; others abſtained from all ſenſual pleaſures; and ſome, as the prieſts of Cybele, caſtrated themſelves. The poſtures of the penitents were different according to the different ſacrifices. The prieſts changed their habits according to the ceremony to be performed; white, purple, and black, were the moſt uſual colours. They caſt into the river, or at leaſt out of the city, the animals or other things that had ſerved for a luſtration or ſacrifice of atonement; and thought themſelves threatened with ſome great misfortune when by chance they trod upon them. Part of theſe ceremonies were aboliſhed by the emperor Conſtantine, and his ſucceſſors: the reſt ſubſiſted till the Gothic kings were maſters of Rome; under whom they expired, excepting what the popes thought proper to adopt and bring into the church.

Luſtration, Luſtre.

For the luſtration, or rather expiation, of the ancient Jews, ſee EXPIATION.

LUSTRE, the gloſs or brightneſs appearing on any thing, particularly on manufactures of ſilk, wool, or ſtuff. It is likewiſe uſed to denote the compoſition or manner of giving that gloſs.

The luſtre of ſilks is given them by waſhing in ſoap, then

Luſtre ‖ Lutetia.

then clear water, and dipping them in alum water cold. To give ſtuffs a beautiful luſtre: For every eight pounds of ſtuff allow a quarter of a pound of linſeed; boil it half an hour, and then ſtrain it through a cloth, and let it ſtand till it is turned almoſt to a jelly: afterwards put an ounce and a half of gum to diſſolve 24 hours; then mix the liquor, and put the cloth into this mixture; take it out, dry it in the ſhade, and preſs it. If once doing is not ſufficient, repeat the operation. Curriers give a luſtre to black leather firſt with juice of barberries, then with gum-arabic, ale, vinegar, and Flanders-glue, boiled together. For coloured leather, they uſe the white of an egg beaten in water. Moroccoes have their luſtre from juice of barberries, and lemon or orange. For hats, the luſtre is frequently given with common water; ſometimes a little black dye is added: the ſame luſtre ſerves for furs, except that for very black furs they ſometimes prepare a luſtre of galls, copperas, Roman alum, ox's marrow, and other ingredients.

LUSTRE, an appellation given to a branched candleſtick, when made of glaſs. See BRANCH and JESSE.

LUSTRINGS. A company was incorporated for making, dreſſing, and luſtrating alamodes and luſtrings in England, who were to have the ſole benefit thereof, by ſtat. 4 and 5 William and Mary. And no foreign ſilks known by the name of *luſtrings* or alamodes are to be imported but at the port of London, &c. Stat. 9. and 10. W. III. c. 43. See SILK.

LUSTRUM, in Roman antiquity, a general muſter and review of all the citizens and their goods, which was performed by the cenſors every fifth year, who afterwards made a ſolemn luſtration. See the article LUSTRATION.

This cuſtom was firſt inſtituted by Servius Tullius, about 180 years after the foundation of Rome. In courſe of time the luſtra were not celebrated ſo often; for we find the fifth luſtrum celebrated at Rome only in the 574th year of that city.

LUTE, or LUTING, among chemiſts, a mixed, tenacious, ductile ſubſtance, which grows ſolid by drying, and, being applied to the juncture of veſſels, ſtops them up ſo as to prevent the air from getting either in or out. See CHEMISTRY-*Index*.

LUTE, is alſo a muſical inſtrument with ſtrings.—The lute conſiſts of four parts, *viz.* the table, the body or belly, which has nine or ten ſides; the neck, which has nine or ten ſtops or diviſions, marked with ſtrings; and the head or croſs, where the ſcrew for raiſing and lowering the ſtrings to a proper pitch of tone are fixed. In the middle of the table there is a roſe or paſſage for the ſound; there is alſo a bridge that the ſtrings are faſtened to, and a piece of ivory between the head and the neck to which the other extremities of the ſtrings are fitted. In playing, the ſtrings are ſtruck with the right hand, and with the left the ſtops are preſſed. The lutes of Bologna are eſteemed the beſt on account of the wood, which is ſaid to have an uncommon diſpoſition for producing a ſweet ſound.

LUTETIA PARISIORUM, (anc. geog.), a town of the Pariſii, in Gallia Celtica, ſituated in an iſland in the Sequana or Seine. It received its name, as ſome ſuppoſe, from the quantity of clay, *lutum*, which is in its neighbourhood. J. Cæſar fortified and embelliſhed it, from which circumſtance ſome authors call it *Julii Civitas*. Julian the apoſtate reſided there for ſome time. It is now *PARIS*, the capital of France; ſo called from its name *Paryis* in the lower age.

Luther.

LUTHER (Martin), the celebrated author of the Reformation, was a native of Eiſleben in Saxony, and born in 1483. Though his parents were poor, he received a learned education; during the progreſs of which, he gave many indications of uncommon vigour and acuteneſs of genius. As his mind was naturally ſuſceptible of ſerious impreſſions, and tinctured with ſomewhat of that religious melancholy which delights in the ſolitude and devotion of a monaſtic life, he retired into a convent of Auguſtinian friars; where he acquired great reputation, not only for piety, but for love of knowledge and unwearied application to ſtudy. The cauſe of this retirement is ſaid to have been, that he was once ſtruck by lightning, and his companion killed by his ſide by the ſame flaſh. He had been taught the ſcholaſtic philoſophy which was in vogue in thoſe days, and made conſiderable progreſs in it: but happening to find a copy of the bible which lay neglected in the library of his monaſtery, he applied himſelf to the ſtudy of it with ſuch eagerneſs and aſſiduity, as quite aſtoniſhed the monks; and increaſed his reputation for ſanctity ſo much, that he was choſen profeſſor firſt of philoſophy, and afterwards of theology, at Wittemberg on the Elbe, where Frederic elector of Saxony had founded an univerſity.

While Luther continued to enjoy the higheſt reputation for ſanctity and learning, Tetzel, a Dominican friar, came to Wittemberg in order to publiſh indulgences. Luther beheld his ſucceſs with great concern; and having firſt inveighed againſt indulgences from the pulpit, he afterwards publiſhed 95 theſes, containing his ſentiments on that ſubject. Theſe he propoſed, not as points fully eſtabliſhed, but as ſubjects of inquiry and diſputation. He appointed a day on which the learned were invited to impugn them either in perſon or by writing; and to the whole he ſubjoined ſolemn proteſtations of his high reſpect for the apoſtolic ſee, and of his implicit ſubmiſſion to its authority. No opponent appeared at the time prefixed; the theſes ſpread over Germany with aſtoniſhing rapidity, and were read with the greateſt eagerneſs.

Though Luther met with no oppoſition for ſome little time after he began to publiſh his new doctrines, it was not long before many zealous champions aroſe to defend thoſe opinions with which the wealth and power of the clergy were ſo ſtrictly connected. Their cauſe, however, was by no means promoted by theſe endeavours; the people began to call in queſtion even the authority of the canon law and of the pope himſelf.—The court of Rome at firſt deſpiſed theſe new doctrines and diſputes; but at laſt the attention of the pope being raiſed by the great ſucceſs of the reformer, and the complaints of his adverſaries, Luther was ſummoned, in the month of July 1518, to appear at Rome, within 60 days, before the auditor of the chamber. One of Luther's adverſaries, named Prierias, who had written againſt him, was appointed to examine his doctrines, and to decide concerning them. The pope wrote at the ſame time to the elector of Saxony, beſeeching him not to protect a man whoſe heretical and profane tenets were ſo ſhocking to pious ears; and enjoined the provincial of the Auguſtinians

Luther. guſtinians to check by his authority the raſhneſs of an arrogant monk, which brought diſgrace upon their order, and gave offence and diſturbance to the whole church.

From theſe letters, and the appointment of his open enemy Prierias to be his judge, Luther eaſily ſaw what ſentence he might expect at Rome; and therefore diſcovered the utmoſt ſolicitude to have his cauſe tried in Germany, and before a leſs ſuſpected tribunal. He wrote a ſubmiſſive letter to the pope, in which he promiſed an unreſerved obedience to his will, for as yet he entertained no doubt of the divine original of the pope's authority; and by the interceſſion of the other profeſſors, Cajetan the pope's legate in Germany was appointed to hear and determine the cauſe. Luther appeared before him without heſitation: but Cajetan thought it below his dignity to diſpute the point with a perſon ſo much his inferior in rank; and therefore required him, by virtue of the apoſtolic powers with which he was clothed, to retract the errors which he had uttered with regard to indulgences and the nature of faith, and to abſtain for the future from the publication of new and dangerous opinions; and at the laſt forbad him to appear in his preſence, unleſs he propoſed to comply with what had been required of him.

This haughty and violent manner of proceeding, together with ſome other circumſtances, gave Luther's friends ſuch ſtrong reaſons to ſuſpect that even the imperial ſafe-conduct would not be able to protect him from the legate's power and reſentment, that they prevailed on him ſecretly to withdraw from Augſburg, where he had attended the legate, and to return to his own country. But before his departure, according to a form of which there had been ſome examples, he prepared a ſolemn appeal from the pope, ill-informed at that time concerning his cauſe, to the pope, when he ſhould receive more full intimation with reſpect to it.—Cajetan, enraged at Luther's abrupt retreat, and at the publication of his appeal, wrote to the elector of Saxony, complaining of both; and requiring him, as he regarded the peace of the church, or the authority of its head, either to ſend that ſeditious monk a priſoner to Rome, or to baniſh him out of his territories. Frederic had hitherto, from political motives, protected Luther, as thinking he might be of uſe in checking the enormous power of the ſee of Rome; and though all Germany reſounded with his fame, the elector had never yet admitted him into his preſence. But upon this demand made by the cardinal, it became neceſſary to throw off ſomewhat of his former reſerve. He had been at great expence and beſtowed much attention on founding a new univerſity, an object of conſiderable importance to every German prince; and foreſeeing how fatal a blow the removal of Luther would be to its reputation, he not only declined complying with either of the pope's requeſts, but openly diſcovered great concern for Luther's ſafety.

The ſituation of our reformer, in the mean time, became daily more and more alarming. He knew very well what were the motives which induced the elector to afford him protection, and that he could by no means depend on a continuance of his friendſhip. If he ſhould be obliged to quit Saxony, he had no other aſylum, and muſt ſtand expoſed to whatever puniſhment the rage or bigotry of his enemies could inflict; and ſo ready were his adverſaries to condemn him, that he had been declared a heretic at Rome before the expiration of the 60 days allowed him in the citation for making his appearance. Notwithſtanding all this, however, he diſcovered no ſymptoms of timidity or remiſſneſs; but continued to vindicate his own conduct and opinions, and to inveigh againſt thoſe of his adverſaries with more vehemence than ever. Being convinced, therefore, that the pope would ſoon proceed to the moſt violent meaſures againſt him, he appealed to a general council, which he affirmed to be the repreſentative of the Catholic church, and ſuperior in power to the pope, who being a fallible man, might err, as St Peter, the moſt perfect of his predeceſſors, had done. Luther.

The court of Rome were equally aſſiduous in the mean time to cruſh the author of theſe new doctrines which gave them ſo much uneaſineſs. A bull was iſſued by the pope, of a date prior to Luther's appeal, in which he magnified the virtues of indulgences, and ſubjected to the heavieſt eccleſiaſtical cenſures all who preſumed to teach a contrary doctrine. Such a clear deciſion of the ſovereign pontiff againſt him might have been very fatal to Luther's cauſe, had not the death of the emperor Maximilian, which happened on January 17. 1519, contributed to give matters a different turn. Both the principles and intereſt of Maximilian had prompted him to ſupport the authority of the ſee of Rome: but, in conſequence of his death, the vicariate of that part of Germany which is governed by the Saxon laws devolved to the elector of Saxony; and, under the ſhelter of his friendly adminiſtration, Luther himſelf enjoyed tranquillity, and his opinions took ſuch root in different places, that they could never afterwards be eradicated. At the ſame time, as the election of an emperor was a point more intereſting to the pope (Leo X.) than a theological controverſy which he did not underſtand, and of which he could not foreſee the conſequences, he was ſo extremely ſolicitous not to irritate a prince of ſuch conſiderable influence in the electoral college as Frederic, that he diſcovered a great unwillingneſs to pronounce the ſentence of excommunication againſt Luther, which his adverſaries continually demanded with the moſt clamorous importunity.

From the reaſon juſt now given, and Leo's natural averſion to ſevere meaſures, a ſuſpenſion of proceeding againſt Luther took place for 18 months, though perpetual negociations were carried on during this interval in order to bring the matter to an amicable iſſue. The manner in which theſe were conducted having given our reformer many opportunities of obſerving the corruption of the court of Rome, its obſtinacy in adhering to eſtabliſhed errors, and its indifference about truth, however clearly propoſed or ſtrongly proved, he began, in 1520, to utter ſome doubts with regard to the divine orignial of the papal authority, which he publicly diſputed with Eccius, one of his moſt learned and formidable antagoniſts. The diſpute was indeciſive, both parties claiming the victory; but it muſt have been very mortifying to the partizans of the Romiſh church to hear ſuch an eſſential point of their doctrine publicly attacked. Luther.

The

Luther. The Papal authority being once ſuſpected, Luther proceeded to puſh on his inquiries and attacks from one doctrine to another, till at laſt he began to ſhake the firmeſt foundations on which the wealth and power of the church were eſtabliſhed. Leo then began to perceive that there were no hopes of reclaiming ſuch an incorrigible heretic; and therefore prepared to denounce the ſentence of excommunication againſt him. The college of cardinals was often aſſembled, in order to prepare the ſentence with due deliberation; and the ableſt canoniſts were conſulted how it might be expreſſed with unexceptionable formality. At laſt it was iſſued on the 15th of June 1520. Forty-one propoſitions, extracted out of Luther's works, were therein condemned as heretical, ſcandalous, and offenſive to pious ears; all perſons were forbidden to read his writings, upon pain of excommunication; ſuch as had any of them in their cuſtody were commanded to commit them to the flames; he himſelf, if he did not, within 60 days, publicly recant his errors, and burn his books, was pronounced an obſtinate heretic, excommunicated, and delivered to Satan for the deſtruction of the fleſh; and all ſecular princes were required, under pain of incurring the ſame cenſure, to ſeize his perſon, that he might be puniſhed as his crimes deſerved.

Luther was not in the leaſt diſconcerted by this ſentence, which he had for ſome time expected. He renewed his appeal to his general council; declared the pope to be that antichriſt, or man of ſin, whoſe appearance is foretold in the New Teſtament; declaimed againſt his tyranny with greater vehemence than ever; and at laſt, by way of retaliation, having aſſembled all the profeſſors and ſtudents in the univerſity of Wittemberg, with great pomp, and in the preſence of a vaſt multitude of ſpectators, he caſt the volumes of the canon law, together with the bull of excommunication, into the flames. The manner in which this action was juſtified, gave ſtill more offence than the action itſelf. Having collected from the canon law ſome of the moſt extravagant propoſitions with regard to the plenitude and omnipotence of the pope's power, as well as the ſubordination of all ſecular juriſdiction to his authority, he publiſhed theſe with a commentary, pointing out the impiety of ſuch tenets, and their evident tendency to ſubvert all civil government.

On the acceſſion of Charles V. to the empire, Luther found himſelf in a very dangerous ſituation. Charles, in order to ſecure the pope's friendſhip, had determined to treat him with great ſeverity. His eagerneſs to gain this point, rendered him not averſe to gratify the papal legates in Germany, who inſiſted, that, without any delay or formal deliberation, the diet then ſitting at Worms ought to condemn a man whom the pope had already excommunicated as an incorrigible heretic. Such an abrupt manner of proceeding, however, being deemed unprecedented and unjuſt by the members of the diet, they made a point of Luther's appearing in perſon, and declaring whether he adhered or not to thoſe opinions which had drawn upon him the cenſures of the church. Not only the emperor, but all the princes through whoſe territories he had to paſs, granted him a ſafe conduct; and Charles wrote to him at the ſame time, requiring his immediate attendance on the diet, and renewing his promiſes of protection from any injury or violence. Luther did not heſitate one moment about yielding obedience; and ſet out for Worms, attended by the herald who had brought the emperor's letter and ſafe-conduct. While on his journey, many of his friends, whom the fate of Huſs, under ſimilar circumſtances, and notwithſtanding the ſame ſecurity of an imperial ſafe-conduct, filled with ſolicitude, adviſed and intreated him not to ruſh wantonly into the midſt of danger. But Luther, ſuperior to ſuch terrors, ſilenced them with this reply, "I am lawfully called (ſaid he) to appear in that city; and thither will I go in the name of the Lord, though as many devils as there are tiles on the houſes were there combined againſt me." Luther.

The reception which he met with at Worms, was ſuch as might have been reckoned a full reward of all his labours, if vanity and the love of applauſe had been the principles by which he was influenced. Greater crowds aſſembled to behold him than had appeared at the emperor's public entry; his apartments were daily filled with princes and perſonages of the higheſt rank; and he was treated with an homage more ſincere, as well as more flattering, than any which preeminence in birth or condition can command. At his appearance before the diet, he behaved with great decency, and with equal firmneſs. He readily acknowledged an exceſs of acrimony and vehemence in his controverſial writings; but refuſed to retract his opinions unleſs he were convinced of their falſehood, or to conſent to their being tried by any other rule than the word of God. When neither threats nor intreaties could prevail on him to depart from this reſolution, ſome of the eccleſiaſtics propoſed to imitate the example of the council of Conſtance, and, by puniſhing the author of this peſtilent hereſy, who was now in their power, to deliver the church at once from ſuch an evil. But the members of the diet refuſing to expoſe the German integrity to freſh reproach by a ſecond violation of public faith, and Charles being no leſs unwilling to bring a ſtain upon the beginning of his adminiſtration by ſuch an ignominious action, Luther was permitted to depart in ſafety. A few days after he left the city, a ſevere edict was publiſhed in the emperor's name, and by authority of the diet, depriving him, as an obſtinate and excommunicated criminal, of all the privileges which he enjoyed as a ſubject of the empire, forbidding any prince to harbour or protect him, and requiring all to ſeize his perſon as ſoon as the term ſpecified in his protection ſhould be expired.

But this rigorous decree had no conſiderable effect; the execution of it being prevented partly by the multiplicity of occupations which the commotions in Spain, together with the wars in Italy and the Low Countries, created to the emperor; and partly by a prudent precaution employed by the elector of Saxony, Luther's faithful patron. As Luther, on his return from Worms, was paſſing near Altenſtrain in Thuringia, a number of horſemen in maſks ruſhed ſuddenly out of a wood, where the elector had appointed them to lie in wait for him, and, ſurrounding his company, carried him, after diſmiſſing all his attendants, to Wortburg, a ſtrong caſtle not far diſtant. There the elector ordered him to be ſupplied with every thing neceſſary or agreeable; but the place of his retreat was carefully concealed, until the fury of the preſent ſtorm

Luther. against him began to abate, upon a change in the political ſyſtem of Europe. In this ſolitude, where he remained nine months, and which he frequently called his *Patmos*, after the name of that iſland to which the apoſtle John was baniſhed, he exerted his uſual vigour and induſtry in defence of his doctrine, or in confutation of his adverſaries, publiſhing ſeveral treatiſes, which revived the ſpirit of his followers, aſtoniſhed to a great degree and diſheartened at the ſudden diſappearance of their leader.

Luther, weary at length of his retirement, appeared publicly again at Wittemberg, upon the 6th of March 1522. He appeared indeed without the elector's leave; but immediately wrote him a letter, to prevent his taking it ill. The edict of Charles V. as ſevere as it was, had given little or no check to Luther's doctrine: for the emperor was no ſooner gone into Flanders, than his edict was neglected and deſpiſed, and the doctrine ſeemed to ſpread even faſter than before. Caroloſtadius, in Luther's abſence, had puſhed things on faſter than his leader; and had attempted to aboliſh the uſe of maſs, to remove images out of the churches, to ſet aſide auricular confeſſion, invocation of ſaints, the abſtaining from meats; had allowed the monks to leave their monaſteries, to neglect their vows, and to marry; in ſhort, had quite changed the doctrine and diſcipline of the church at Wittemberg: all which, though not againſt Luther's ſentiments, was yet blamed by him, as being raſhly and unſeaſonably done. Lutheraniſm was ſtill confined to Germany: it was not got to France; and Henry VIII. of England made the moſt rigorous acts to hinder it from invading his realm. Nay, he did ſomething more: to ſhow his zeal for religion and the holy ſee, and perhaps his ſkill in theological learning, he wrote a treatiſe *Of the ſeven ſacraments*, againſt Luther's book *Of the captivity of Babylon*; which he preſented to Leo X. in October 1521. The pope received it very favourably; and was ſo well pleaſed with the king of England, that he complimented him with the title of *Defender of the faith*. Luther, however, paid no regard to his kingſhip; but anſwered him with great ſharpneſs, treating both his perſon and performance in the moſt contemptuous manner. Henry complained of Luther's rude uſage of him to the princes of Saxony: and Fiſher, biſhop of Rocheſter, replied to his anſwer, in behalf of Henry's treatiſe: but neither the King's complaint, nor the biſhop's reply, was attended with any viſible effects.

Luther, though he had put a ſtop to the violent proceedings of Caroloſtadius, now made open war with the pope and biſhops; and, that he might make the people deſpiſe their authority as much as poſſible, he wrote one book againſt the pope's bull, and another againſt the order falſely called the *order of biſhops*. The ſame year, 1522, he wrote a letter, dated July the 29th, to the aſſembly of the ſtates of Bohemia; in which he aſſured them that he was labouring to eſtabliſh their doctrine in Germany, and exhorted them not to return to the communion of the church of Rome; and he publiſhed alſo, this year, a tranſlation of the New Teſtament in the German tongue, which was afterwards corrected by himſelf and Melancthon. This tranſlation having been printed ſeveral times, and being in every body's hands, Ferdinand archduke of Auſtria, the emperor's brother, made a very ſevere edict, to hinder the farther publication of it; and forbad all the ſubjects of his imperial majeſty to have any copies of it, or of Luther's other books. Some other princes followed his example; and Luther was ſo angry at it, that he wrote a treatiſe, *Of the ſecular power*, in which he accuſes them of tyranny and impiety. The diet of the empire was held at Nurenburg, at the end of the year; to which Hadrian VI. ſent his brief, dated November the 25th: for Leo X. died upon the 2d of December 1521, and Hadrian had been elected pope upon the 9th of January following. In his brief, among other things, he obſerves to the diet, how he had heard, with grief, that Martin Luther, after the ſentence of Leo X. which was ordered to be executed by the edict of Worms, continued to teach the ſame errors, and daily to publiſh books full of hereſies: that it appeared ſtrange to him, that ſo large and ſo religious a nation could be ſeduced by a wretched apoſtate friar: that nothing, however, could be more pernicious to Chriſtendom: and that therefore he exhorts them to uſe their utmoſt endeavours to make Luther, and the authors of theſe tumults, return to their duty; or, if they refuſe and continue obſtinate, to proceed againſt them according to the laws of the empire, and the ſeverity of the laſt edict. Luther.

The reſolution of this diet was publiſhed in the form of an edict, upon the 6th of March 1523; but it had no effect in checking the Lutherans, who ſtill went on in the ſame triumphant manner. This year Luther wrote a great many pieces: among the reſt, one upon the dignity and office of the ſupreme magiſtrate; which Frederic elector of Saxony is ſaid to have been highly pleaſed with. He ſent, about the ſame time, a writing in the German language to the Waldenſes, or Pickards, in Bohemia and Moravia, who had applied to him "about worſhipping the body of Chriſt in the euchariſt." He wrote alſo another book, which he dedicated to the ſenate and people of Prague, "about the inſtitution of miniſters of the church." He drew up a form of ſaying maſs. He wrote a piece, entitled, *An example of popiſh doctrine and divinity*; which Dupins calls *a ſatire againſt nuns and thoſe who profeſs a monaſtic life*. He wrote alſo againſt the vows of virginity, in his preface to his commentary on 1 Cor. viii. And his exhortations here were, it ſeems, followed with effects: for ſoon after, nine nuns, among whom was Catharine de Bore, eloped from the nunnery at Nimptſchen, and were brought, by the aſſiſtance of Leonard Coppen, a burgeſs of Torgau, to Wittemberg. Whatever offence this proceeding might give to the Papiſts, it was highly extolled by Luther; who, in a book written in the German language, compares the deliverance of theſe nuns from the ſlavery of a monaſtic life, to that of the ſouls which Jeſus Chriſt has delivered by his death. This year Luther had occaſion to canonize two of his followers, who, as Melchior Adam relates, were burnt at Bruſſels in the beginning of July, and were the firſt who ſuffered martyrdom for his doctrine. He wrote alſo a conſolatory epiſtle to three noble ladies at Miſnia, who were baniſhed from the duke of Saxony's court at Friburg, for reading his books.

In the beginning of the year 1524, Clement VII. ſent

Luther. sent a legate into Germany to the diet, which was to be held at Nurenburg Hadrian VI. died in October 1523, and was ſucceeded by Clement upon the 19th of November. A little before his death he canonized Benno, who was biſhop of Meiſſen in the time of Gregory VII. and one of the moſt zealous defenders of the holy ſee Luther, imagining that this was done directly to oppoſe him, drew up a piece with this title, *Againſt the New Idol and Old Devil ſet up at Meiſſen*; in which he treats the memory of Gregory with great freedom, and does not ſpare even Hadrian. Clement VII.'s legate repreſented to the diet of Nurenburg the neceſſity of enforcing the execution of the edict of Worms, which had been ſtrangely neglected by the princes of the empire: but, notwithſtanding the legate's ſolicitations, which were very preſſing, the decrees of that diet were thought ſo ineffectual, that they were condemned at Rome, and rejected by the emperor. It was in this year that the diſpute between Luther and Eraſmus, about free-will, began. Eraſmus had been much courted by the Papiſts to write againſt Luther; but he was all along of opinion, that writing would not be found an effectual way to end the differences and eſtabliſh the peace of the church. However, tired out at length with the importunities of the pope and the Catholic princes, and deſirous at the ſame time to clear himſelf from the ſuſpicion of favouring a cauſe which he would not ſeem to favour, he reſolved to write againſt Luther, though, as he tells Melanchthon, it was with ſome reluctance, and choſe free-will for the ſubject. His book was intitled, *A Diatrila, or Conference about Free-will*; and was written with much moderation, and without perſonal reflections. He tells Luther in the preface, "That he ought not to take his diſſenting from him in opinion ill, becauſe he had allowed himſelf the liberty of differing from the judgment of popes, councils, univerſities, and doctors of the church." Luther was ſome time before he anſwered Eraſmus's book; but at laſt publiſhed a treatiſe *De Servo Arbitrio*, or *Of the Servitude of Man's Will*; and though Melanchthon had promiſed Eraſmus, that Luther ſhould anſwer him with civility and moderation, yet Luther had ſo little regard to Melanchthon's promiſe, that he never wrote any thing ſharper. He accuſed Eraſmus of being careleſs about religion, and little ſolicitous what became of it, provided the world continued in peace; and that his notions were rather philoſophical than Chriſtian. Eraſmus immediately replied to Luther, in a piece called *Hyperaſpiſtes*; in the firſt part of which he anſwers his arguments, and in the ſecond his perſonal reflections.

In October 1524, Luther flung off the monaſtic habit; which, though not premeditated and deſigned, was yet a very proper preparative to a ſtep he took the year after; we mean, his marriage with Catharine de Bore. Catharine de Bore was a gentleman's daughter, who had been a nun, and was taken, as we have obſerved, out of the nunnery of Nimptſchen, in the year 1523. Luther had a deſign, as Melchior Adam relates, to marry her to Glacius, a miniſter of Ortamunden: but ſhe did not like Glacius; and ſo Luther married her himſelf upon the 13th of June 1525. This conduct of his was blamed not only by the Catholics, but, as Melanchthon ſays, by thoſe of his own party. He was even for ſome time aſhamed of it himſelf; and owns, that his marriage had made him ſo deſpicable, that he hoped his humiliation would rejoice the angels, and vex the devils. Melanchthon found him ſo afflicted with what he had done, that he wrote ſome letters of conſolation to him. It was not ſo much the marriage, as the circumſtances of the time, and the precipitation with which it was done, that occaſioned the cenſures paſſed upon Luther. He married all of a ſudden, and at a time when Germany was groaning under the miſeries of a war which was ſaid at leaſt to be owing to Lutheraniſm. Then, again, it was thought an indecent thing in a man of 42 years of age, who was then, as he pretended, reſtoring the Goſpel, and reforming mankind, to involve himſelf in marriage with a woman of 26, either through incontinence, or any account whatever. But Luther, as ſoon as he had recovered himſelf a little from this abaſhment, aſſumed his former air of intrepidity, and boldly ſupported what he had done with reaſons. "I took a wife (ſays he), in obedience to my father's commands; and haſtened the conſummation, in order to prevent impediments, and ſtop the tongues of ſlanderers." It appears from his own confeſſion, that this reformer was very fond of Mrs de Bore, and uſed to call her *his Catharine*; which made profane people think and ſay wicked things of him: "And therefore (ſays he) I married of a ſudden, not only that I might not be obliged to hear the clamours which I knew would be raiſed againſt me, but to ſtop the mouths of thoſe who reproached me with Catharine de Bore." Luther alſo gives us to underſtand, that he did it partly as concurring with his grand ſcheme of oppoſing the Catholics. Luther.

Luther, notwithſtanding, was not himſelf altogether ſatisfied with theſe reaſons. He did not think the ſtep he had taken could be ſufficiently juſtified upon the principles of human prudence; and therefore we find him, in other places, endeavouring to account for it from a ſupernatural impulſe. But whether there was any thing divine in it or not, Luther found himſelf extremely happy in his new ſtate, and eſpecially after his wife had brought him a ſon. "My rib Kate (ſays he in the joy of his heart) deſires her compliments to you, and thanks you for the favour of your kind letter. She is very well, through God's mercy. She is obedient and complying with me in all things; and more agreeable, I thank God, than I could have expected; ſo that I would not change my poverty for the wealth of Cræſus." He was heard to ſay (Seckendorf tells us), that he would not exchange his wife for the kingdom of France, nor for the riches of the Venetians; and that for three reaſons: firſt, Becauſe ſhe had been given him by God, at the time when he implored the aſſiſtance of the Holy Ghoſt in finding a good wife; ſecondly, Becauſe, though ſhe was not without faults, yet ſhe had fewer than other women; and, thirdly, Becauſe ſhe religiouſly obſerved the conjugal fidelity ſhe owed him. There went at firſt a report, that Catharine de Bore was brought to bed ſoon after her marriage with Luther; but Eraſmus, who had wrote that news to his friends, acknowledged the falſity of it a little after.

His marriage, however, did not retard his activity and diligence in the work of reformation. He reviſed the Augſburg confeſſion of faith, and apology for the

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Luther. Proteſtants, when the Proteſtant religion was firſt eſtabliſhed on a firm baſis. See PROTESTANTS and REFORMATION.

After this, Luther had little elſe to do than to ſit down and contemplate the mighty work he had finiſhed: for that a ſingle monk ſhould be able to give the church ſo rude a ſhock, that there needed but ſuch another entirely to overthrow it, may very well ſeem a mighty work. He did indeed little elſe: for the remainder of his life was ſpent in exhorting princes, ſtates, and univerſities, to confirm the reformation which had been brought about through him; and publiſhing from time to time ſuch writings as might encourage, direct, and aid, them in doing it. The emperor threatened temporal puniſhment with armies, and the pope eternal with bulls and anathemas; but Luther cared for none of their threats. His friend and coadjutor Melancthon was not ſo indifferent; for Melancthon had a great deal of ſoftneſs, moderation, and diffidence in his make, which made him very uneaſy, and even ſorrowful, in the preſent diſorders. Hence we find many of Luther's letters written on purpoſe to ſupport and comfort him under theſe ſeveral diſtreſſes and anxieties.

In the year 1533, Luther wrote a conſolatory epiſtle to the citizens of Oſchatz, who had ſuffered ſome hardſhips for adhering to the Augſburg confeſſion of faith; in which, among other things, he ſays: "The devil is the hoſt, and the world is his inn; ſo that wherever you come, you ſhall be ſure to find this ugly hoſt." He had alſo about this time a terrible controverſy with George duke of Saxony, who had ſuch an averſion to Luther's doctrine, that he obliged his ſubjects to take an oath that they would never embrace it. However, 60 or 70 citizens of Leipſic were found to have deviated a little from the Catholic way in ſome point or other, and they were known previouſly to have conſulted Luther about it; upon which George complained to the elector John, that Luther had not only abuſed his perſon, but alſo preached up rebellion among his ſubjects. The elector ordered Luther to be acquainted with this; and to be told at the ſame time, that if he did not clear himſelf of the charge, he could not poſſibly eſcape puniſhment. But Luther eaſily refuted the accuſation, by proving, that he had been ſo far from ſtirring up his ſubjects againſt him, on the ſcore of religion, that, on the contrary, he had exhorted them rather to undergo the greateſt hardſhips, and even ſuffer themſelves to be baniſhed.

In the year 1534, the Bible tranſlated by him into German was firſt printed, as the old privilege, dated at Bibliopolis, under the elector's hand, ſhows; and it was publiſhed the year after. He alſo publiſhed this year a book againſt maſſes and the conſecration of prieſts, in which he relates a conference he had with the devil upon thoſe points; for it is remarkable in Luther's whole hiſtory, that he never had any conflicts of any kind within, but the devil was always his antagoniſt. In February 1537, an aſſembly was held at Smalkald about matters of religion, to which Luther and Melancthon were called. At this meeting Luther was ſeized with ſo grievous an illneſs, that there were no hopes of his recovery. He was afflicted with the ſtone, and had a ſtoppage of urine for 11 days. In this terrible condition he would needs undertake to travel, notwithſtanding all that his friends could ſay or do to prevent him: his reſolution, however, was attended with a good effect; for the night after his departure he began to be better. As he was carried along, he made his will, in which he bequeathed his deteſtation of Popery to his friends and brethren; agreeably to what he often uſed to ſay: *Peſtis eram vivus, moriens ero mors tua, papa;* that is, "I was the plague of Popery in my life, and ſhall continue to be ſo in my death." Luther.

This year the Pope and the court of Rome, finding it impoſſible to deal with the Proteſtants by force, began to have recourſe to ſtratagem. They affected therefore to think, that though Luther had indeed carried things on with a high hand and to a violent extreme, yet what he had pleaded in defence of theſe meaſures was not entirely without foundation. They talked with a ſeeming ſhow of moderation; and Pius III. who ſucceeded Clement VII. propoſed a reformation firſt among themſelves, and even went ſo far as to fix a place for a council to meet at for that purpoſe. But Luther treated this farce as it deſerved to be treated; unmaſked and detected it immediately; and, to ridicule it the more ſtrongly, cauſed a picture to be drawn, in which was repreſented the pope ſeated on high upon a throne, ſome cardinals about him with foxes tails on, and ſeeming to evacuate upwards and downwards (*ſurſum deorſum repurgare*, as Melchior Adam expreſſes it). This was fixed over-againſt the title-page, to let the readers ſee at once the ſcope and deſign of the book; which was, to expoſe that cunning and artifice with which thoſe ſubtle politicians affected to cleanſe and purify themſelves from their errors and ſuperſtitions. Luther publiſhed about the ſame time A Confutation of the pretended Grant of Conſtantine to Sylveſter Biſhop of Rome; and alſo ſome letters of John Huſs, written from his priſon at Conſtance to the Bohemians.

In this manner was Luther employed till his death, which happened in the year 1546. That year, accompanied by Melancthon, he paid a viſit to his own country, which he had not ſeen for many years, and returned again in ſafety. But ſoon after he was called thither again by the earls of Mansfeldt, to compoſe ſome differences which had ariſen about their boundaries. Luther had not been uſed to ſuch matters; but becauſe he was born at Iſleben, a town in the territory of Mansfeldt, he was willing to do his country what ſervice he could, even in this way. Preaching his laſt ſermon therefore at Wittemberg, upon the 17th of January, he ſet off on the 23d; and at Hall in Saxony lodged with Juſtus Jonas, with whom he ſtaid three days, becauſe the waters were out. Upon the 28th, he paſſed over the river with his three ſons and Dr Jonas; and being in ſome danger, he ſaid to the Doctor, "Do not you think it would rejoice the devil exceedingly, if I and you, and my three ſons, ſhould be drowned?" When he entered the territories of the earls of Mansfeldt, he was received by 100 horſemen or more, and conducted in a very honourable manner; but was at the ſame time ſo very ill, that it was feared he would die. He ſaid, that theſe fits of ſickneſs often came upon him when he had any great buſineſs to undertake: of this, however, he did not recover; but died upon the 18th of February, in Luther.

the

Luther, Lutheraniſm.

the 63d year of his age. A little before he expired, he admoniſhed thoſe that were about him to pray to God for the propagation of the Goſpel; "becauſe (ſaid he) the council of Trent, which had ſat once or twice, and the pope, would deviſe ſtrange things againſt it." Soon after, his body was put into a leaden coffin, and carried with funeral pomp to the church at Iſleben, when Dr Jonas preached a ſermon upon the occaſion. The earls of Mansfeldt deſired that his body ſhould be interred in their territories; but the elector of Saxony inſiſted upon his being brought back to Wittemberg; which was accordingly done: and there he was buried with the greateſt pomp that perhaps ever happened to any private man. Princes, earls, nobles, and ſtudents without number, attended the proceſſion; and Melancthon made his funeral oration.

A thouſand lies were invented by the Papiſts about Luther's death. Some ſaid that he died ſuddenly; others, that he killed himſelf; others, that the devil ſtrangled him; others, that his corpſe ſtunk ſo abominably, that they were forced to leave it in the way, as it was carried to be interred. Nay, lies were invented about his death, even while he was yet alive. Luther, however, to give the moſt effectual refutation of this account of his death, put forth an advertiſement of his being alive; and, to be even with the Papiſts for the malice they had ſhown in this lie, wrote a book at the ſame time to prove, that "the papacy was founded by the devil."

Luther's works were collected after his death, and printed at Wittemberg in 7 vols folio. Catharine de Bore ſurvived her huſband a few years; and continued the firſt year of her widowhood at Wittemberg, though Luther had adviſed her to ſeek another place of reſidence. She went from thence in the year 1547, when the town was ſurrendered to the emperor Charles V. Before her departure, ſhe had received a preſent of 50 crowns from Chriſtian III. king of Denmark; and the elector of Saxony, and the counts of Mansfeldt, gave her good tokens of their liberality. With theſe additions, to what Luther had left her, ſhe had wherewithal to maintain herſelf and her family handſomely. She returned to Wittemberg, when the town was reſtored to the elector; where ſhe lived in a very devout and pious manner, till the plague obliged her to leave it again in the year 1552. She ſold what ſhe had at Wittemberg; and retired to Torgau, with a reſolution to end her life there. An unfortunate miſchance befel her in her journey thither, which proved fatal to her. The horſes growing unruly, and attempting to run away, ſhe leaped out of the vehicle ſhe was conveyed in; and, by leaping, got a fall, of which ſhe died about a quarter of a year after, at Torgau, upon the 20th of December 1552. She was buried there in the great church, where her tomb and epitaph are ſtill to be ſeen; and the univerſity of Wittemberg, which was then at Torgau becauſe the plague raged at Wittemberg, made a public programma concerning the funeral pomp.

LUTHERANISM, the ſentiments of Martin Luther with regard to religion. See LUTHER.

Lutheraniſm has undergone ſome alterations ſince the time of its founder.—Luther rejected the epiſtle of St James, as inconſiſtent with the doctrine of St Paul, in relation to juſtification; he alſo ſet aſide the Apocalypſe: both which are now received as canonical in the Lutheran church.

Luther reduced the number of ſacraments to two, *viz.* baptiſm, and the euchariſt: but he believed the impanation, or conſubſtantiation, that is, that the matter of the bread and wine remain with the body and blood of Chriſt; and it is in this article that the main difference between the Lutheran and Engliſh churches conſiſts.

Luther maintained the maſs to be no ſacrifice; exploded the adoration of the hoſt, auricular confeſſion, meritorious works, indulgences, purgatory, the worſhip of images, &c. which had been introduced in the corrupt times of the Romiſh church. He alſo oppoſed the doctrine of free-will, maintained predeſtination, and aſſerted our juſtification to be ſolely by the imputation of the merits and ſatisfaction of Chriſt. He alſo oppoſed the faſtings in the Romiſh church, monaſtical vows, the celibate of the clergy, &c.

Lutherans || Lutti.

LUTHERANS, the Chriſtians who follow the opinions of Martin Luther, one of the principal reformers of the church in the 16th century. See LUTHER.

The Lutherans, of all Proteſtants, are thoſe who differ leaſt from the Romiſh church; as they affirm, that the body and blood of Chriſt are materially preſent in the ſacrament of the Lord's ſupper, though in an incomprehenſible manner; and likewiſe repreſent ſome religious rites and inſtitutions, as the uſe of images in churches, the diſtinguiſhing veſtments of the clergy, the private confeſſion of ſins, the uſe of wafers in the adminiſtration of the Lord's ſupper, the form of exorciſm in the celebration of baptiſm, and other ceremonies of the like nature, as tolerable, and ſome of them as uſeful. The Lutherans maintain, with regard to the divine decrees, that they reſpect the ſalvation or miſery of men, in conſequence of a previous knowledge of their ſentiments and characters, and not as free and unconditional, and as founded on the mere will of God. Towards the cloſe of the laſt century, the Lutherans began to entertain a greater liberality of ſentiment than they had before adopted; though in many places they perſevered longer in ſevere and deſpotic principles than other Proteſtant churches. Their public teachers now enjoy an unbounded liberty of diſſenting from the deciſions of thoſe ſymbols or creeds which were once deemed almoſt infallible rules of faith and practice, and of declaring their diſſent in the manner they judge the moſt expedient. Moſheim attributes this change in their ſentiments to the maxim which they generally adopted, that Chriſtians were accountable to God alone for their religious opinions; and that no individual could be juſtly puniſhed by the magiſtrate for his erroneous opinions, while he conducted himſelf like a virtuous and obedient ſubject, and made no attempts to diſturb the peace and order of civil ſociety.

LUTHERN, in architecture, a kind of window over the cornice, in the roof of a building; ſtanding perpendicularly over the naked of a wall, and ſerving to illuminate the upper ſtory.

Lutherns are of various forms; as ſquare, ſemicircular, round, called *bull's eyes*, *flat arches*, &c.

LUTRA, in zoology. See MUSTELA.

LUTTI (Beneditto), an eminent painter, born at Flo-

Lutzen || Luxurians

Florence in 1666. He was the diſciple of Antonio Dominico Gabiani, and his merit was judged equal to that of his maſter: he painted few beſide eaſel pieces; and his works were much valued and ſought for in England, France, and Germany. The emperor knighted him; and the elector of Mentz, together with his patent of knighthood, ſent him a croſs ſet with diamonds. Lutti was never ſatisfied in finiſhing his pictures; yet though he often retouched them, they never appeared laboured. He died in 1724.

LUTZEN, a town of Upper Saxony in Germany; famous for a battle fought here in 1632, when Guſtavus Adolphus king of Sweden was killed. It is ſituated on the river Elſter, in E. Long. 12. 37. N. Lat. 51. 20.

LUXATION, is when any bone is moved out of its place or articulation, ſo as to impede or deſtroy its proper office or motion. See SURGERY.

LUXEMBURG, a city of the Auſtrian Netherlands, and capital of a duchy of the ſame name. It is ſeated partly on a hill, and partly on a plain; but is very ſtrong both by art and nature. It is but indifferently built, though there are ſome good ſtone houſes in it. There is nothing very remarkable among the ſtructures but the Jeſuits church; which is a handſome edifice, after the modern taſte. It was taken by Louis XIV. in 1634; who ſo augmented the fortifications, that it is now one of the ſtrongeſt towns in Europe. It was ceded to Spain by the treaty of Ryſwick; but the French took it again in 1701, and gave it up to the houſe of Auſtria by the treaty of Utrecht. It is 25 miles ſouth-weſt of Treves, and 100 weſt of Mentz. E. Long. 6. 10. N. Lat. 49. 52.

LUXEMBURG (the duchy of), is one of the 17 provinces of the Netherlands. It is bounded on the eaſt by the archbiſhoprick of Treves; on the ſouth, by Lorrain; on the weſt, partly by Champagne, and partly by the biſhoprick of Liege, which likewiſe, with part of Limburg, bound it on the north. It lies in the foreſt of Ardenne, which is one of the moſt famous in Europe. In ſome places it is covered with mountains and woods, and in general it is fertile in corn and wine; and here are a great number of iron-mines. The principal rivers are, the Moſelle, the Sour, the Ourte, and the Semoy. It belongs partly to the houſe of Auſtria, and partly to the French; and Thionville is the capital of the French part.

LUXEMBURG (François Henry de Montmorenci), duke of, and marſhal of France, a renowned general in the ſervice of Louis XIV. was born in 1628. He was with the prince of Conde at the battle of Rocroy, in 1643; and in 1668 diſtinguiſhed himſelf at the conqueſt of Franche Compté. In 1672, he commanded in chief the French army in Holland; when he defeated the enemy near Woerden and Bodegrave, and was univerſally admired for the fine retreat he made in 1673. He became marſhal of France in 1675; gained the battle of Flerus in 1690, that of Steenkirk in 1692, and that of Nerwind in 1693. He died at Verſailles in 1695.

LUXURIANS FLOS, "a luxuriant or double flower;" a flower, ſome of whoſe parts are increaſed in number, to the diminution or entire excluſion of others.

The parts that are augmented or multiplied in luxuriant flowers, are the flower-cup and petals, which Linnæus conſiders as the teguments or covers of the flower; the parts that are diminiſhed, or entirely excluded, are the ſtamina or chives, which the ſame author denominates the male organs of generation. Luxurians, Luxury.

Luxuriance in flowers is capable of the three following varieties.

1. A flower is ſaid to be MULTIPLIED *(flos multiplicatus)*, when the increaſe of the petals is not ſuch as to exclude all the ſtamina: in this ſenſe, flowers are peoperly ſaid to be double, triple, or quadruple, according to the number of multiplications of the petals.

2. A flower is ſaid to be FULL, *(flos plenus)*, when, by the multiplication of the petals, all the ſtamina are excluded. Such are moſt of the double flowers that engage the attention of floriſts.

3. A flower is ſaid to be PROLIFIC *(flos prolifer)*, which produces flowers, and ſometimes leaves, from its centre.

For a particular deſcription of each of theſe kinds of luxuriance in flowers, ſee the articles *MULTIPLICATUS Flos*, *PLENUS Flos*, and *PROLIFER Flos*.

Many natural orders of plants do not in any circumſtances produce luxuriant flowers. Of this kind are the maſqued-flowers of Tournefort, excepting calve's-ſnout; the rough-leaved, umbelliferous, ſtarry plants, and ſuch as flower at the joints, of Ray: ſome umbelliferous flowers, however, are *prolific*.

The pea-bloom, or butterfly-ſhaped flowers, are rarely rendered double; ſome inſtances, however, of luxuriance, are obſerved in a ſpecies of ladies-finger, coronilla, and broom.

All luxuriant flowers are vegetable monſters. Such as are perfectly full, by which we mean the greateſt degree of luxuriance, cannot be propagated by ſeeds; becauſe theſe, for want of impregnation, can never ripen. Full flowers therefore are very properly denominated by Linnæus *eunuchs*. This higheſt degree of luxuriance is very common in carnation, lychnis, anemone, ſtock, Indian creſs, roſe, marſh marigold, ranunculus, violet, pœony, and narciſſus.

Flowers which do not exclude all the ſtamina, perfect their ſeeds. Of this kind are poppy, fennel-flower, campanula, and ſome others.

Some flowers, as thoſe of the water-lily, fig-marigold, and cactus, have many rows or ſeries of petals, without the number of ſtamina being in the leaſt diminiſhed. Such flowers are by no means to be reckoned luxuriant, in the ſlighteſt degree.

Luxuriance in flowers is generally owing to exceſs of nouriſhment.

LUXURY; voluptuouſneſs, or an extravagant indulgence in diet, dreſs, and equipage.

Luxury, among the Romans, prevailed to ſuch a degree, that ſeveral laws were made to ſuppreſs, or at leaſt limit it. The extravagance of the table began about the time of the battle of Actium, and continued in great exceſs till the reign of Galba. Peacocks, cranes of Malta, nightingales, veniſon, wild and tame fowl, were conſidered as delicacies. A profuſion of proviſions was the reigning taſte. Whole wild boars were often ſerved up, and ſometimes they were filled with various ſmall animals, and birds of different kinds: this diſh they called the *Trojan horſe*, in alluſion to the wooden horſe filled with ſoldiers.

Luxury. Fowls and game of all ſorts were ſerved up in whole pyramids, piled up in diſhes as broad as moderate tables. Lucullus had a particular name for each apartment; and in whatever room he ordered his ſervants to prepare the entertainment, they knew by the direction the expence to which they were to go. When he ſupped in the Apollo, the expence was fixed at 50,000 *drachmæ*, that is L. 1250. M. Antony provided eight boars for 12 gueſts. Vitellius had a large ſilver platter, ſaid to have coſt a million of *ſeſterces*, called *Minerva's buckler*. In this he blended together the livers of gilt-heads, the brains of pheaſants and peacocks, the tongues of phenicopters, and the milts of lampreys. Caligula ſerved up to his gueſts pearls of great value diſſolved in vinegar; the ſame was done alſo by Clodius the ſon of Æſop the tragedian. Apicius laid aſide 90,000,000 of *ſeſterces*, beſides a mighty revenue, for no other purpoſe but to be ſacrificed to luxury: finding himſelf involved in debt, he looked over his accounts, and though he had the ſum of 10,000,000 of *ſeſterces* ſtill left, he poiſoned himſelf for fear of being ſtarved to death.

The Roman laws to reſtrain luxury were *Lex Orchia*, *Fannia*, *Didia*, *Licinia*, *Cornelia*, and many others: But all theſe were too little; for as riches increaſed amongſt them, ſo did ſenſuality.

What were the ideas of luxury entertained in England about two centuries ago, may be gathered from the following paſſage of Holinſhed; who, in a diſcourſe prefixed to his Hiſtory, ſpeaking of the increaſe of luxury, ſays, "Neither do I ſpeak this in reproach of any man, God is my judge; but to ſhow, that I do rejoice rather to ſee how God has bleſſed us with his good gifts, and to behold how that in a time wherein all things are grown to the moſt exceſſive prices, we yet do find means to obtain and atchieve ſuch furniture as heretofore was impoſſible. There are old men yet dwelling in the village where I remain, which have noted three things to be marvelouſly altered in England within their ſound remembrance. One is the multitude of chimneys lately erected; whereas in their young days there were not above two or three, if ſo many, in moſt uplandiſh towns of the realm (the religious houſes, and manor places of their lords, always excepted, and peradventure ſome great perſonages), but each made his fire againſt a reredoſs [ſkreen] in the hall where he dreſſed his meat and dined.—The ſecond is the great amendment of lodging; for, ſaid they, our fathers and we ourſelves have lain full oft upon ſtraw pallets covered only with a ſheet, under coverlits made of a dogſwaine or horharriots (to uſe their own terms), and a good log under their head inſtead of a bolſter.—If it were ſo that the father or good man of the houſe had a mattraſs, or flock bed and ſheets, a ſack of chaff to reſt his head upon, he thought himſelf to be as well lodged as the lord of the town. So well were they contented, that pillows (ſaid they) were thought meet only for women in childbed; as for ſervants, if they had any ſheet above them, it was well; for ſeldom had they any under their bodies to keep them from pricking ſtraws, that ran oft through the canvas and their hardened hides.—The third thing they tell of, is the exchange of treene [wooden] platters into pewter, and wooden ſpoons into ſilver or tin; for ſo common were all ſorts of treene veſſels in old times, that a man ſhould hardly find four pieces pewter (of which one was peradventure a ſalt) in a good farmer's houſe. Again, in times paſt, men were contented to dwell in houſes builded of ſallow, willow, &c. ſo that the uſe of oak was in a manner dedicated wholly unto churches, religious houſes, princes palaces, navigation, &c. But now willow, &c. are rejected, and nothing but oak any where regarded; and yet ſee the change, for when our houſes were builded of willow, then had we oaken men; but now that our houſes are come to be made of oak, our men are not only become willow, but a great many altogether of ſtraw, which is a ſore alteration. In theſe, the courage of the owner was a ſufficient defence to keep the houſe in ſafety; but now the aſſurance of the timber muſt defend the men from robbing. Now have we many chimneys, and yet our tenderlins complain of rheums, catarrhs, and poſes; then had we none but reredoſes, and our heads did never ach. For as the ſmoke in thoſe days were ſuppoſed to be a ſufficient hardening for the timber of the houſe; ſo it was reputed a far better medicine to keep the goodman and his family from the quacks or poſe; wherewith, as then, very few were acquainted. Again, our pewterers in time paſt employed the uſe of pewter only upon diſhes and pots, and a few other trifles for ſervice; whereas now they are grown into ſuch exquiſite cunning, that they can in a manner imitate by infuſion any form or faſhion, of cup, diſh, ſalt, bowl, or goblet, which is made by the goldſmiths craft, though they be ever ſo curious and very artificially forged. In ſome places beyond the ſea, a garniſh of good flat Engliſh pewter (I ſay flat, becauſe diſhes and platters in my time began to be made deep, and like baſons, and are indeed more convenient both for ſauce and keeping the meat warm) is eſteemed ſo precious as the like number of veſſels that are made of fine ſilver."

Particular inſtances of luxury in *eating*, however, might be adduced from an earlier period, ſurpaſſing even the extravagance of the Romans. Thus, in the 10th year of the reign of Edward IV. 1470, George Nevill, brother to the earl of Warwick, at his inſtalment into the archiepiſcopal ſee of York, entertained moſt of the nobility and principal clergy, when his bill of fare was 300 quarters of wheat, 350 tuns of ale, 104 tuns of wine, a pipe of ſpiced wine, 80 fat oxen, ſix wild bulls, 1004 wethers, 300 hogs, 300 calves, 3000 geeſe, 3000 capons, 300 pigs, 100 peacocks, 200 cranes, 200 kids, 2000 chickens, 4000 pigeons, 4000 rabbits, 204 bitterns, 4000 ducks, 200 pheaſants, 500 partridges, 2000 woodcocks, 400 plovers, 100 curlews, 100 quails, 1000 egrets, 200 rees, 400 bucks, does, and roebucks, 1506 hot veniſon paſties, 4000 cold ditto, 1000 diſhes of jelly parted, 4000 diſhes of jelly plain, 4000 cold cuſtards, 2000 hot cuſtards, 300 pikes, 300 breams, eight ſeals, four porpuſſes, 400 tarts. At this feaſt the earl of Warwick was ſteward, the earl of Bedford treaſurer, and lord Haſtings comptroller, with many more noble officers; 1000 ſervitors, 62 cooks, 515 menial apparitors in the kitchen. —But ſuch was the fortune of the man, that after his extreme prodigality he died in the moſt abject but unpitied poverty, *vinctus jacuit in ſumma inopia*.

And as to *dreſs*, luxury in that article ſeems to have

Luxury.

attained a great height long before Holinſhed's time: For in the reign of Edward III. we find no fewer than ſeven ſumptuary laws paſſed in one ſeſſion of parliament to reſtrain it. It was enacted, that men ſervants of lords, as alſo of tradeſmen and artiſans, ſhall be content with one meal of fiſh or fleſh every day; and the other meals, daily, ſhall be of milk, cheeſe, butter, and the like. Neither ſhall they uſe any ornaments of gold, ſilk, or embroidery; nor their wives and daughters any veils above the price of twelvepence. Artiſans and yeomen ſhall not wear cloth above 40s. the whole piece (the fineſt then being about L.6 per piece), nor the ornaments before named. Nor the women any veils of ſilk, but only thoſe of thread made in England. Gentlemen under the degree of knights, not having L.100 yearly in land, ſhall not wear any cloth above 4½ marks the whole piece. Neither ſhall they or their females uſe cloth of gold, ſilver, or embroidery, &c. But eſquires having L.200 *per annum* or upwards of rent, may wear cloths of five marks the whole piece or cloth; and they and their females may alſo wear ſtuff of ſilk, ſilver, ribbons, girdles, or furs. Merchants, citizens, burghers, and artificers of tradeſmen, as well of London as elſewhere, who have goods and chattels of the clear value of L.500, and their females, may wear as is allowed to gentlemen and eſquires of L.100 *per annum*. And merchants, citizens, and burgeſſes, worth above L.1000 in goods and chattels, may (and their females) wear the ſame as gentlemen of L.200 *per annum*. Knights of 200 marks yearly may wear cloth of ſix marks the cloth, but no higher; but no cloth of gold, nor furred with ermine: but all knights and ladies having above 400 marks yearly, up to L.1000 *per annum*, may wear as they pleaſe, ermine excepted; and they may wear ornaments of pearl and precious ſtones for their heads only. Clerks having degrees in cathedrals, colleges, &c. may wear as knights and eſquires of the ſame income. Plowmen, carters, ſhepherds, and ſuch like, not having 40s. value in goods or chattels, ſhall wear no ſort of cloth but blanket and ruſſet lawn of 12d. and ſhall wear girdles and belts; and they ſhall only eat and drink ſuitable to their ſtations. And whoſoever uſes other apparel than is preſcribed by the above laws ſhall forfeit the ſame.

Concerning the general utility of luxury to a ſtate, there is much controverſy among the political writers. Baron Monteſquieu lays it down, that luxury is neceſſary in monarchies, as in France; but ruinous to democracies, as in Holland. With regard therefore to Britain, whoſe government is compounded of both ſpecies, it is held to be a dubious queſtion, how far private luxury is a public evil; and, as ſuch, cogniſable by public laws. And indeed our legiſlators have ſeveral times changed their ſentiments as to this point; for formerly there were a number of penal laws exiſting to reſtrain exceſs in apparel, chiefly made in the reigns of Edward III. IV. and Henry VIII. a ſpecimen of which we have inſerted above. But all of them it appeared expedient to repeal at an after period. In fact, although luxury will of neceſſity increaſe according to the influx of wealth, it may not be for the general benefit of commerce to impoſe, as in the above cited laws, an abſolute prohibition of every degree of it: yet, for the good of the public, it may be neceſſary that ſuch as go beyond proper bounds in eating, drinking, and wearing what by no means is ſuitable to their ſtation, ſhould be taxed accordingly, could it be done without including thoſe who have a better title to ſuch indulgence. This is certainly, however, a point which ſhould be maturely weighed before executed; and, in mercantile countries at leaſt, ſuch reſtraints may be found prejudicial, moſt likely impracticable, eſpecially where true liberty is eſtabliſhed. Sir William Temple obſerves, ſpeaking of the trade and riches, and at the ſame time of the *frugality* of the Hollanders, "That ſome of our maxims are not ſo *certain* as *current* in politics: as that encouragement of exceſs and luxury, if employed in the conſumption of *native* commodities, is of advantage to trade. It may be ſo to that which impoveriſhes, but not to that which enriches a country. It is indeed leſs prejudicial, if it lies in *native* than in *foreign* wares; but the humour of *luxury* and expence cannot ſtop at certain bounds; what begins in *native* will proceed in *foreign* commodities; and though the example ariſe among idle perſons, yet the imitation will run into all degrees, even of thoſe men by whoſe induſtry the nation ſubſiſts. And beſides, the more of *our own* we ſpend, the leſs we ſhall have to ſend abroad; and ſo it will come to paſs, that while we drive a vaſt trade, yet, by buying much more than we *ſell*, we ſhall come to be poor at laſt."

Lybia ‖ Lycaon.

LYBIA, or LIBYA, a name anciently given to all that part of Africa lying between the border of Egypt and the river Triton; and comprehending *Cyrenaica*, *Marmarica*, and the Regio *Syrtica*. See theſe articles.

LYCÆUM, Λυκειον, in antiquity, the name of a celebrated ſchool or academy at Athens, where Ariſtotle explained his philoſophy. The place was compoſed of porticoes, and trees planted in the quincunx form, where the philoſophers diſputed walking. Hence *philoſophy of the Lycæum* is uſed to ſignify the philoſophy of Ariſtotle, or the Peripatetic philoſophy. Suidas obſerves, that the Lycæum took its name from its having been originally a temple of Apollo Lycæus; or rather a portico or gallery built by Lycæus ſon of Apollo: but others mention it to have been built by Piſiſtratus or Pericles.

LYCÆUS (anc. geog.), a mountain of Arcadia, ſacred to Jupiter; whence *Jupiter Lycæus* (Pliny). Sacred alſo to Pan (Virgil): and hence *Lycæa*, the rites performed to Pan on this mountain; which Evander carrying with him to Latium, were called *Lupercalia* (Virgil).

LYCAON (fab. hiſt.), the firſt king of Arcadia, ſon of Pelaſgus and Meliboea. He built a town called Lycoſura, on the top of mount Lycæus, in honour of Jupiter. He had many wives, by whom he had a daughter called Calliſto, and 50 ſons. He was ſucceeded on the throne by Nyctimus, the eldeſt of his ſons. He lived about 1820 years before the Chriſtian æra.—Another king of Arcadia celebrated for his cruelties. He was changed into a wolf by Jupiter, becauſe he offered human victims on the altar of the god Pan. Some attribute this metamorphoſis to another cauſe. The ſins of mankind, as they relate, were become ſo enormous, that Jupiter viſited the earth to puniſh wickedneſs and impiety. He came to Arcadia, where he

Lycaonia, Lychnis.

was announced as a god, and the people began to pay proper adoration to his divinity. Lycaon, however, who uſed to ſacrifice all ſtrangers to his wanton cruelty, laughed at the pious prayers of his ſubjects; and to try the divinity of the god, he ſerved up human fleſh on his table. This impiety ſo irritated Jupiter, that he immediately deſtroyed the houſe of Lycaon, and changed him into a wolf.

LYCAONIA, (anc. geog.), a ſmall country of the Hither Aſia, contained between Pamphylia to the ſouth, Cappadocia to the north, Piſidia and Phrygia to the weſt, and Armenia Minor to the eaſt. *Lycaones*, the people. This country, though ſituated very near mount Taurus, and part of it on it, yet the Romans reckoned it into Aſia intra Taurum. *Arcadia*, anciently called *Lycaonia*, (Stephanus.)—Alſo an iſland in the Tiber, joined to Rome by a bridge, and to the land by another, namely, the Ceſtius and Fabricius.

LYCHNIS, CAMPION, in botany, including alſo the *Bachelor's-button*, *Catch-fly*, &c: A genus of the pentagynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 22d order, *Caryophyllæ*. The calyx is monophyllous, oblong, and ſmooth; there are five unguiculated petals; with the ſegments of the limb almoſt biſid; the capſule quinquelocular.

Species, &c. 1. The Chalcedonica, or Chalcedonian ſcarlet lychnis, hath a fibrated perennial root; upright, ſtraight, hairy, annual ſtalks, riſing three or four feet high; garniſhed with long, ſpear-pointed, cloſe-ſitting leaves, by pairs oppoſite; and the ſtalk crowned by a large, compact, flat bunch of beautiful ſcarlet or flame-coloured flowers, appearing in June and July. Of this there are varieties, with ſingle ſcarlet flowers, with large double ſcarlet flowers of exceeding beauty and elegance, with pale-red flowers, and with white flowers. Of theſe varieties, the double ſcarlet lychnis is ſuperior to all for ſize and elegance: the flowers being large, very double, and collected into a very large bunch, exhibit a charming appearance; the ſingle ſcarlet kind is alſo very pretty; and the others effect an agreeable variety with the ſcarlet kinds. 2. The diœcia, or diœcious lychnis, commonly called *bachelors-button*, hath fibrated perennial roots; upright ſtalks, branching very diffuſe and irregular, two or three feet high; having oval, acute-pointed, rough leaves, by pairs oppoſite; and all the branches terminated by cluſters of diœcious flowers of different colours and properties in the varieties; flowering in April and May. The varieties, are the common ſingle red-flowered bachelors button, double red, double white, and ſingle white-flowered. The double varieties are exceedingly ornamental in their bloom; the flowers large, very double, and continue long in blow; the ſingle red ſort grows wild by ditch ſides and other moiſt places in many parts of England; from which the doubles were accidentally obtained by culture in gardens. The flowers are often diœcious, *i. e.* male and female on diſtinct plants. 3. The viſcaria, or viſcous German lychnis, commonly called *catch-fly*, hath fibry perennial roots; crowned by a tuft of long graſſy leaves cloſe to the ground; many erect, ſtraight, ſingle ſtalks, riſing a foot and a half or two feet high, exſuding from their upper part a viſcous or clammy matter; garniſhed with long narrow leaves, by pairs oppoſite; and terminated by many reddiſh purple flowers, in cluſters one above another, forming a ſort of long looſe ſpike; all the flowers with entire petals; flowering in May. Of this alſo there are varieties with ſingle red flowers, with double red flowers, and with white flowers. The double variety is conſiderably the moſt eligible for general culture, and is propagated in plenty by parting the roots. All the varieties of this ſpecies emitting a glutinous liquid matter from their ſtalks, flies happening to light thereon ſometimes ſtick and entangle themſelves, whence the plant obtains the name Catch-fly. 4. The flos-cuculi, cuckoo-flower lychnis, commonly called *ragged-robin*, hath fibry perennial roots; upright, branchleſs, channelled ſtalks, riſing near two feet high; garniſhed with long, narrow, ſpear-ſhaped leaves, in pairs oppoſite; and terminated by branchy foot-ſtalks, ſuſtaining many purple, deeply quadrifid flowers; appearing in May. The flowers having each petal deeply quadrifid in a torn or ragged-like manner, the plant obtained the cant name of Ragged-robin. There are varieties with ſingle flowers and double flowers. The double ſort is a large, very multiple, fair flower: it is an improved variety of the ſingle, which grows wild in moſt of our moiſt meadows, and is rarely cultivated; but the double, being very ornamental, merits culture in every garden. All the four ſpecies and reſpective varieties are very hardy; all fibrous-rooted, the roots perennial; but are annual in ſtalks, which riſe in ſpring, flower in ſummer, ſucceeded in the ſingles by plenty of ſeed in autumn, by which all the ſingle varieties may be raiſed in abundance, but the doubles only by dividing the roots, and ſome by cuttings of the flower-ſtalks.

Lycia || Lycodontes

LYCIA, a country of Aſia Minor, bounded by the Mediterranean on the ſouth, Caria on the weſt, Pamphylia on the eaſt, and Phrygia on the north. It was anciently called *Milyas*, and *Tremile*, from the Milyæ, or Solymi, a people of Crete, who came to ſettle there. The country received the name of *Lycia* from Lycus the ſon of Pandion, who eſtabliſhed himſelf there. The inhabitants have been greatly commended by all the ancients for their ſobriety and juſtice. They were conquered by Crœſus king of Lydia, and afterwards by Cyrus. Though they were ſubject to the power of Perſia, yet they were governed by their own kings, and only paid a yearly tribute to the Perſian monarch. They became part of the Macedonian empire when Alexander came into the eaſt, and afterwards were ceded to the houſe of the Seleucidæ. The country was reduced into a Roman province by the emperor Claudius.

LYCIUM, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 28th order, *Luridæ*. The corolla is tubular, having its throat cloſed up with the beard of the filaments; the berry is bilocular. There are eight ſpecies, natives of various countries.

LYCODONTES, in natural hiſtory, the petrified teeth of the lupus-piſcis, or wolf-fiſh, frequently found foſſile. They are of different ſhapes; but the moſt common kind riſe into a ſemiorbicular form, and

Lycomedes, Lycoperdon.

are hollow within, ſomewhat reſembling an acorn-cup; this hollow is found ſometimes empty, and ſometimes filled with the ſtratum in which it is immerſed. Many of them have an outer-circle, of a different colour from the reſt.

LYCOMEDES, (fab. hiſt.), a king of Scyros an iſland in the Ægean ſea. He was ſon of Apollo and Parthenope. He was ſecretly entruſted with the care of young Achilles, whom his mother Tethis had diſguiſed in woman's cloaths, to remove him from the Trojan war, where ſhe knew he muſt unavoidably periſh. Lycomedes has rendered himſelf famous for his treachery to Theſeus, who had implored his protection when driven from his throne of Athens by the uſurper Mneſtheus. Lycomedes, as it is reported, either envious of the fame of his illuſtrious gueſts, or bribed by the emiſſaries of Mneſtheus, led Theſeus to an elevated place, on pretence to ſhow him the extent of his dominions, and perfidiouſly threw him down a precipice, where he was killed.

LYCOPERDON, in botany: A genus of the natural order of fungi, belonging to the cryptogamia claſs of plants. The fungus is roundiſh, and full of farinaceous ſeeds. There are 10 ſpecies, of which the following are the moſt remarkable.

1. The tuber, truffles, or ſubterraneous puff-balls, is a native of woods both in Scotland and England. It is a ſubterraneous fungus, growing generally in cluſters three or four inches under ground, without any viſible root. The figure of it is nearly ſpherical, the ſize that of a potato; the exterior coat at firſt white, afterwards black, and ſtudded with pyramidical or polyhedrous tubercles; the internal ſubſtance ſolid and callous, of a dirty-white or pale-brown colour, grain'd like a nutmeg with ſerpentine lines; in which, according to Micheli, are imbedded minute oval capſules, containing each from two to four round warted ſeeds. The truffles of Great Britain ſeldom exceed three or four ounces in weight; but in Italy, and ſome other parts of the continent, they are ſaid to have been found of the enormous ſize of eight and even 14 pounds. They are received at our tables, either freſh and roaſted like potatoes, or dried and ſliced into ragouts. They have a volatile and ſomewhat urinous ſmell, and are reputed to be aphrodiſiacal. Dogs are with much pains taught to hunt for them by the ſcent, and to ſcratch up the ground under which they lie.

2. The boviſta, or common puff-ball, is frequent in meadows and paſtures in the autumn. It varies exceedingly in ſize, figure, ſuperficies, and colour. In general, it conſiſts of a ſack or bag, having a root at its baſe, and the bag compoſed of three membranes, an epidermis, a tough white ſkin, and an interior coat which adheres cloſely to the central pith. The pith in the young plants is of a yellowiſh colour, at firſt firm and ſolid, but ſoon changes into a cellular ſpongy ſubſtance, full of a dark dull-green powder, which diſcharges itſelf through an aperture at the top of the fungus, which aperture is formed of lacerated ſegments, in ſome varieties reflexed. The powder is believed to be the ſeeds, which through a microſcope appear of a ſpherical form, and to be annexed to elaſtic hairs. See *Haller's Hiſt. Helvet. n.* 2172.

Among the numerous varieties of this fungus, the glabrum is moſt remarkable. It is a ſmooth ſeſſile kind, of a nearly ſpherical form, puckered or contracted at the root. This ſometimes grows to an enormous ſize. It has been found in England as big as a man's head; and at Carraria, near Padua in Italy, ſpecimens have been gathered, weighing 25 pounds, and meaſuring two yards in circumference: but its more ordinary ſize is that of a walnut or an apple.

Lycoperſicon, Lycopodium.

The varieties of this ſpecies have no limits, being frequently found to run into one another; the ſcaly, warty, and echinated coats turning ſmooth as the plants grow old, and the neck of the fungus having no determinate length. The natural colour of the puff-ball is either white, grey, or aſh-coloured: but is ſometimes found yellowiſh, tawny, and browniſh. The internal ſpongy part of it, bound on to wounds, is eſteemed good to ſtop bleedings. Preſſed and dried in an oven, the puff-ball becomes a kind of tinder, the ſmoke of which is ſaid to intoxicate bees. See *Gent. Mag.* July 1766. The Italians fry the great variety, and indeed any of the others when young, and eat them with ſalt and oil, according to the relation of Marſigli.

LYCOPERSICON. See SOLANUM.

LYCOPODIUM, or CLUB-MOSS; a genus of the natural order of muſci, belonging to the cryptogamia claſs of plants. The antheræ are bivalved and ſeſſile; there are no calyptra. There are 24 ſpecies; of which the following are the moſt remarkable.

1. The *clavatum*, or common club-moſs, is common in dry and mountainous places, and in fir foreſts. The ſtalk is proſtrate, branched, and creeping, from a foot to two or three yards long; the radicles woody. The leaves are numerous, narrow, lanceolated, acute, often incurved at the extremity, terminated with a long white hair, and every where ſurround the ſtalk. The peduncles are erect, firm, and naked (except being thinly ſet with lanceolate ſcales), and ariſe from the ends of the branches. They are generally two or three inches long, and terminated with two cylindrical yellowiſh ſpikes, imbricated with oval-acute ſcales, finely lacerated on the edges, and ending with a hair. In the *ala* or boſom of the ſcale is a kidney-ſhaped capſule, which burſts with elaſticity when ripe, and throws out a light yellow powder, which, blown into the flame of a candle, flaſhes with a ſmall exploſion. The Swedes make mats of this moſs to rub their ſhoes upon. In Ruſſia, and ſome other countries, the powder of the capſules is uſed in medicine to heal galls in children, chops in the ſkin, and other ſores. It is alſo uſed to powder over officinal pills, and to make artificial lightning at theatres. The Poles make a decoction of the plant, and, dipping a linen cloth into it, apply it to the heads of perſons afflicted with the diſeaſe called the *plica polonica*, which is ſaid to be cured by this kind of fomentation.

2. The *ſelago*, or fir club-moſs, is common in the Highland mountains of Scotland, and in the Hebrides. The ſtalk at the baſe is ſingle and reclining; but a little higher is divided into upright dichotomous branches, from two to ſix inches high, ſurrounded with eight longitudinal oblique ſeries of lanceolate, ſmooth, rigid, imbricated leaves. Near the ſummits of the branches, in the *alæ* of the leaves, are placed ſingle kidney-ſhaped capſules, conſiſting of two valves, which open horizontally like the ſhells of an oyſter,

Lycopodium || Lymphæa

and caſt out a fine yellow powder. Theſe capſules Linnæus ſuppoſes to be *antheræ*, or male parts of fructification. In the *alæ* alſo of many of the leaves, near the tops of the branches, are often found what the ſame great author calls *female flowers*, but which the ingenious Haller eſteems to be only gems or buds of a future plant. They conſiſt, firſt, of four ſtiff, lanceolate, incurved, minute leaves, one of the outermoſt longer and larger than the reſt. Theſe are ſuppoſed to correſpond to the *calyx* in regular flowers. Again, at the bottom of this *calyx* are five ſmall pellucid ſubſtances reſembling leaves, viſible only by a microſcope, which are ſuppoſed analogous to piſtils. Theſe, in time, grow up into three large broad leaves, two of the five united together like the hoof of an ox; with a third narrower one annexed at the baſe, and two other minute ones oppoſite to the other three. Theſe five leaves are joined at the baſe; and in autumn, falling from the *calyx*, vegetate, and produce a new plant. See a diſſertation *De ſeminibus muſcorum*, *Amænit. Academ.* II. p. 261. In the iſland of Raaſay, near Sky, in Roſsſhire, and ſome other places, the inhabitants make uſe of this plant inſtead of alum, to fix the colours in dyeing. The Highlanders alſo ſometimes take an infuſion of it as an emetic and cathartic: but it operates violently; and, unleſs taken in a ſmall doſe, brings on giddineſs and convulſions. Linnæus informs us, that the Swedes uſe a decoction of it to deſtroy lice on ſwine and other animals.

LYCOPOLIS, or LYCON, (anc. geog.) ſo called from the worſhip of wolves. *Lycopolitæ*, the people; *Lycopolites*, the diſtrict. There were two towns of this name, one in the Delta, or Lower Egypt, near the Mediterranean; the other in the Thebais, or Higher Egypt, in the northern part, to the weſt of the Nile

LYCOPHRON, a famous Greek poet and grammarian, born at Colchis in Eubœa, flouriſhed about 304 B. C. and, according to Ovid, was killed by an arrow. He wrote 20 tragedies; but all his works are loſt, except a poem intitled *Caſſandra*, which contains a long train of predictions, which he ſuppoſes to have been made by Caſſandra, Priam's daughter. This poem is extremely obſcure. The beſt edition of it is that of Dr Potter, printed at Oxford in 1697, folio.

LYCOPSIS, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 41ſt order, *Aſperifoliæ*. The corolla has an incurvated tube.

LYCOPUS, in botany: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The corolla is quadrifid, with one of the ſegments emarginated; the ſtamina ſtanding aſunder, with four retuſe ſeeds.

LYCURGIA, a feſtival obſerved by the Spartans, in memory of their lawgiver Lycurgus, whom they honoured with a temple and anniverſary ſacrifice.

LYMPHÆA, were artificial caves or grottos amongſt the Romans, furniſhed with a great many tubes, canals, and various hydraulic apparatus, thro' which the water guſhed out upon the ſpectators unexpectedly whilſt they were admiring the beautiful arrangement of the ſhell-work in the grotto.

Lycurgus || Lydgate.

LYCURGUS, the celebrated legiſlator of the Spartans, was the ſon of Eunomes king of Sparta. ——He travelled to Greece, to the iſle of Crete, to Egypt, and even to the Indies, to converſe with the ſages and learned men of thoſe countries, and to learn their manners, their cuſtoms, and their laws. After the death of his brother Polydectes, who was king of Sparta, his widow offered the crown to Lycurgus, promiſing that ſhe would make herſelf miſcarry of the child of which ſhe was pregnant, provided he would marry her; but Lycurgus nobly refuſed theſe advantageous offers, and afterwards contented himſelf with being tutor to his nephew Charillus, and reſtored to him the government when he came of age; but notwithſtanding this regular and generous conduct, he was accuſed of a deſign to uſurp the crown. This calumny obliged him to retire to the iſland of Crete, where he applied himſelf to the ſtudy of the laws and cuſtoms of nations. At his return to Lacedemon, he reformed the government: and, to prevent the diſorders occaſioned by luxury and the love of riches, he prohibited the uſe of gold and ſilver; placed all the citizens in a ſtate of equality; and introduced the ſtricteſt temperance, the moſt exact diſcipline, and thoſe admirable laws which (a few excepted) have been celebrated by all hiſtorians. It is ſaid, that, to engage the Lacedemonians to obſerve them inviolably, he made them promiſe with an oath not to change any part of them till his return; and that he afterwards went to the iſland of Crete, where he killed himſelf, after having ordered that his aſhes ſhould be thrown into the ſea, for fear leſt if his body ſhould be carried to Sparta the Lacedemonians would think themſelves abſolved from their oath. He flouriſhed about 870 B. C.

LYDD, a town of Kent in England, two miles and a half ſouth-weſt of Romney, of which town and port it is a member, and 71 miles from London. It is a populous town, with a market on Thurſday, and fair on July 24th. It is incorporated by the name of a bailiff, elected July 22d, jurats, and commonalty. In the beach near Stone-end, is a heap of ſtones, fancied to be the tomb of Criſpin and Criſpianus. And near the ſea is a place called *Holmſtone*, conſiſting of beach and pebble-ſtones, which abounds nevertheleſs with holm trees. Here is a charity ſchool.

LYDGATE (John), called the *Monk of Bury*; not, as Cibber conjectures, becauſe he was a native of that place, for he was born about the year 1380, in the village of Lydgate; but becauſe he was a monk of the Benedictine convent at St Edmund's-Bury. After ſtudying ſome time in our Engliſh univerſities, he travelled to France and Italy; and, having acquired a competent knowledge of the languages of thoſe countries, he returned to London, where he opened a ſchool, in which he inſtructed the ſons of the nobility in polite literature. At what time he retired to the convent of St Edmund's-Bury, does not appear; but he was certainly there in 1415. He was living in 1446, aged about 66; but in what year he died is not known. Lydgate, according to Pits, was an elegant poet, a perſuaſive rhetorician, an expert mathematician, an acute philoſopher, and a tolerable divine. He was a voluminous writer; and, conſidering the age in which he lived, an excellent poet. His

language

Lydia. language is leſs obſolete, and his verſification much more harmonious, than the language and verſification of Chaucer, who wrote about half a century before him. He wrote, 1. Hiſtory of the Theban war, printed at the end of Chaucer's works, 1561, 1602, 1687. 2. Poemation of good counſel; at the end of Chaucer's works. 3. The life of Hector; London 1594, fol. printed by Groſs, dedicated to Henry V. 3. Life of the Bleſſed Virgin; printed by Caxton. 4. The proverbs of Lydgate upon the fall of princes; printed by Wink. Word. Lond. . . . . 4to. 5. Diſpute of the horſe, the ſheep, and the gooſe; printed in Caxton's Collect. 4to. 6. The temple of braſs; among the works of Chaucer. 7. London lickpenny; *vide* Stowe's hiſtory, &c. &c. Beſides an incredible number of other poems and tranſlations preſerved in various libraries, and of which the reader will find a catalogue in biſhop Tanner.

LYDIA (anc. geog.), a celebrated kingdom of Aſia Minor.—All the ancient writers tell us, that Lydia was firſt called *Mæonia* or *Meonia*, from Meon king of Phrygia and Lydia; and that it was known under no other denomination till the reign of Atys, when it began to be called *Lydia* from his ſon Lydus. Bochart finding in his learned collection of Phœnician words the verb *luz*, ſignifying "to wind," and obſerving that the country we are ſpeaking of is watered by the Mæander ſo famous for its windings, concludes that it was thence named *Lydia*, or *Ludia*. As to the ancient name of Mæonia, he takes it to be a Greek tranſlation of the Phœnician word *lud*; wherein he agrees in ſome meaſure with Stephanus, who derives the name of Mæonia from Mæon the ancient name of the Mæander. Some take the word *mæonia* to be a tranſlation of a Hebrew word ſignifying "metal," becauſe that country, ſay they, was in former times enriched above any other with mines. Though Lydia and Mæonia are by moſt authors indifferently uſed for one and the ſame country, yet they are ſometimes diſtinguiſhed; that part where mount Tmolus ſtood, watered by the Pactolus, being properly called *Mæonia*; and the other, lying on the coaſt, *Lydia*. This diſtinction is uſed by Homer, Callimachus, Dionyſius, and other ancient writers. In after ages, when the Ionians, who had planted a colony on the coaſt of the Egean Sea, began to make ſome figure, that part was called *Ionia*, and the name of *Lydia* given to the ancient Mæonia.—Lydia, according to Pliny, Ptolemy, and other ancient geographers, was bounded by the Myſia Major on the north, by Caria on the ſouth, by Phrygia Major on the eaſt, and Ionia on the weſt, lying between the 37th and 39 degrees of north latitude. What the ancients ſtyle the kingdom of *Lydia* was not confined within theſe narrow boundaries, but extended from Halys to the Egean ſea. Pliny's deſcription includes Æolia, lying between the Hermus and the Caicus.

As to the origin of the Lydians, Joſephus, and after him all the eccleſiaſtic writers, derive them from Lud Shem's fourth ſon; but this opinion has no other foundation than the ſimilitude of names. Some of the ancients will have the Lydians to be a mixed colony of Phrygians, Myſians, and Carians. Others finding ſome conformity in religion and religious ceremonies between the Egyptians and Tuſcans who were a Lydian colony, conclude them, without any farther evidence, to be originally Egyptians. All we know for certain is, that the Lydians were a very ancient nation, as is manifeſt from their very fables; for Atys, Tantalus, Pelops, Niobe, and Arachne, are all ſaid to have been the children of Lydus. And Zanthus in his *Lydiaca*, quoted by Stephanus, informs us, that the ancient city of Aſcalon, one of the five ſatrapies of the Philiſtines, mentioned in the books of Joſhua and the Judges, was built by one Aſcalus a Lydian, whom Achiamus king of Lydia had appointed to command a body of troops which he ſent, we know not on what occaſion, into Syria. The Heraclidæ, or kings of Lydia, deſcended from Hercules, began to reign before the Trojan war; and had been preceded by a long ſeries of ſovereigns ſprung from Atys, and hence ſtyled *Atyadæ*: a ſtrong proof of the antiquity of that kingdom. Lydia.

The Lydians began very early to be ruled by kings whoſe government ſeems to have been truly deſpotic and the crown hereditary. We read of three diſtinct races of kings reigning over Lydia, viz. the Atyadæ, the Heraclidæ, and the Mermnadæ.

The *Atyadæ* were ſo called from Atys the ſon of Cotys and grandſon of Manes the firſt Lydian king. But the hiſtory of this family is obſcure and fabulous.

The Atyadæ were ſucceeded by the *Heraclidæ*, or the deſcendants of Hercules. For Hercules being, by the direction of the oracle, ſold as a ſlave to Omphale a queen of Lydia to expiate the murder of Iphitus, had, during his captivity, by one of her ſlaves, a ſon named *Cleolaus*, whoſe grandſon Argon was the firſt of the Heraclidæ that aſcended the throne of Lydia. This race is ſaid to have reigned 505 years, the father ſucceeding the ſon for 22 generations. They began to reign about the time of the Trojan war. The laſt of the family was the unhappy Candaules, who loſt both his life and kingdom by his imprudence. An event of which we have the following account by Herodotus. Candaules had a wife whom he paſſionately loved, and believed the moſt beautiful of her ſex. He extolled her charms to Gyges his favourite, whom he uſed to entruſt with his moſt important affairs; and the more to convince him of her beauty, reſolved to ſhow her to him quite naked: he accordingly placed him in the porch of her chamber where the queen uſed to undreſs when ſhe went to bed, ordering him to retire after he ſhould have ſeen her, and take all poſſible care not to be obſerved. But notwithſtanding all the caution he could uſe, ſhe plainly diſcovered him going out; and though ſhe did not doubt but it was her huſband's contrivance, yet ſhe paſſed that night in a ſeeming tranquillity, ſuppreſſing her reſentment till next morning, while ſhe ſent for Gyges, and reſolutely told him that he muſt either by his death atone for the criminal action he had been guilty of, or put to death Candaules the contriver of it, and receive both her and the kingdom of Lydia for his reward. Gyges at firſt earneſtly begged of her that ſhe would not drive him to the neceſſity of ſuch a choice. But finding that he could not prevail with her, and that he muſt either kill his maſter or die himſelf, he choſe the former part of the alternative. Being led by the queen to the ſame place where her huſband had poſted him the night before, he ſtabbed

Lydia. bed the king while he was aſleep, married the queen, and took poſſeſſion of the kingdom, in which he was confirmed by the anſwer of the Delphic oracle. The Lydians having taken up arms to revenge the death of their prince, an agreement was made between them and the followers of Gyges, that if the oracle ſhould declare him to be lawful king of Lydia he ſhould be permitted to reign; if not, he ſhould reſign the crown to the Heraclidæ. The anſwer of the oracle proving favourable to Gyges, he was univerſally acknowledged for lawful king of Lydia. Candaules is ſaid to have purchaſed a picture painted by Bularchas, repreſenting a battle of the Magnetes, for its weight in gold; a circumſtance which ſhows how early the art of painting began to be in requeſt, for Candaules was cotemporary with Romulus.

Gyges having thus poſſeſſed himſelf of the kingdom of Lydia, ſent many rich and valuable preſents to the oracle of Delphos, among others, ſix cups of gold weighing 30 talents, and greatly eſteemed for the workmanſhip. He made war on Miletus and Smyrna, took the city of Colophon, and ſubdued the whole country of Troas. In his reign, and by his permiſſion, the city of Abydus was built by the Mileſians. Plutarch and other writers relate his acceſſion to the crown of Lydia in a quite different manner, and tell us, without making any mention of the queen, that Gyges rebelled againſt Candaules and ſlew him in an engagement. In Gyges began the third race called *Mermnadæ;* who were alſo, properly ſpeaking, Heraclidæ, being deſcended from a ſon of Hercules by Omphale. Gyges reigned 38 years, and was ſucceeded by his ſon Ardyes.

This prince carried on the war againſt the Mileſians which his father had begun, and poſſeſſed himſelf of Priene, in thoſe days a ſtrong city. In his reign the Cimerians invaded and over-run all Aſia Minor; but what battles were fought between the Lydians and theſe invaders, and with what ſucceſs, we find no where mentioned. Herodotus only informs us, that in the time of Ardyes they poſſeſſed themſelves of Sardis, the metropolis of Lydia, but could never reduce the caſtle. Ardyes reigned 49 years, and was ſucceeded by his ſon Sadyattes, who reigned 12 years, and warred moſt part of his reign with the Mileſians.

After him came his ſon Alyattes, who for the ſpace of five years continued the war which his father had begun againſt the Mileſians, ravaging their country, and about harveſt time carrying away all their corn yearly, in order to oblige them, for want of proviſions, to ſurrender their city, which he knew he could not reduce any other way, the Mileſians being at that time maſters of the ſea. In the 12th year of this war the Lydians having ſet fire to the corn in the fields, the flames were carried by a violent wind, which happened to blow at that time, to the temple of Minerva at Aſſeſus, and burnt it down to the ground. Not long after, Alyattes falling ſick, ſent to conſult the oracle at Delphos; which refuſed to return any anſwer till ſuch time as the king ſhould rebuild the temple of Minerva at Aſſeſus. Alyattes, thus warned, diſpatched ambaſſadors to Miletus, enjoining them to conclude a truce with the Mileſians till the temple ſhould be rebuilt. On the arrival of the ambaſſadors, Thraſybulus, then king of Miletus, commanded all the corn that was at that time in the city to be brought into the market-place, ordering the citizens to banquet in public, and revel as if the city were plentifully ſtored with all manner of proviſions. This ſtratagem Thraſybulus practiſed, to the end that the ambaſſadors ſeeing ſuch quantities of corn, and the people every where diverting themſelves, might acquaint their maſter with their affluence, and divert him from purſuing the war. As Thraſybulus had deſigned, ſo it happened; for Alyattes, who believed the Mileſians greatly diſtreſſed for proviſions, receiving a different account from his ambaſſadors, changed the truce into a laſting peace, and ever afterwards lived in amity and friendſhip with Thraſybulus and the Mileſians. He was ſucceeded, after a reign of 57 years, by his ſon Crœſus, whoſe uninterrupted proſperity, in the firſt years of his reign, far eclipſed the glory of all his predeceſſors. He was the firſt that made war on the Epheſians, whoſe city he beſieged and took notwithſtanding their conſecrating it to Diana, and faſtening the walls by a rope to her temple, which was ſeven ſtadia diſtant from the city. After the reduction of Epheſus, he attacked, under various pretences, the Ionians and Æolians, obliging them, and all the other Greek ſtates of Aſia, to pay him a yearly tribute. Having met with ſuch extraordinary ſucceſs by land, the Lydian prince determined to render his power equally conſpicuous by ſea. For this purpoſe he thought ſeriouſly of equipping a fleet; with which he purpoſed to invade and conquer the Grecian iſlands directly fronting his dominions. But this deſign, which, conſidering the ſlow progreſs in maritime power among the nations moſt diligent to attain it, would probably have failed of ſucceſs, was prevented by the advice of a philoſophical traveller conveyed in ſuch a lively turn of wit, as eaſily changed the reſolution of the king. Bias of Priené in Ionia, ſome ſay Pittacus of Mitylene in the iſle of Leſbos, while he travelled after the Grecian cuſtom, from curioſity and a love of knowledge, was preſented to Crœſus at the Lydian court; and being aſked by that prince what news from Greece; he anſwered with a republican freedom, that the iſlanders had collected powerful ſquadrons of cavalry with an intention of invading Lydia. "May the gods grant (ſaid Crœſus), that the Greeks, who are unacquainted with horſemanſhip, ſhould attack the diſciplined valour of the Lydian cavalry; there would ſoon be an end to the conteſt." "In the ſame manner (replied Bias), as if the Lydians, who are totally unexperienced in naval affairs, ſhould invade the Grecians by ſea." Struck by the acuteneſs of this unexpected obſervation, Crœſus deſiſted from his intended expedition againſt the iſlands, and inſtead of employing new means for extending his conqueſts, determined peaceably to enjoy the laurels which he had won, and to diſplay the grandeur which he had attained. But his happineſs was ſoon after allayed by the death of his favourite ſon Atys, who was unfortunately killed at the chace of a wild boar. For this loſs he continued diſconſolate for two years and in a ſtate of inaction, till the conqueſts of Cyrus, and growing power of the Perſians, roufed up his martial ſpirit, and diverted his mind to other thoughts. He apprehended that the ſucceſs which attended Cyrus in all his undertakings, might at laſt

prove

Lydia. prove dangerous to himſelf, and therefore reſolved to put a ſtop, if poſſible, to his progreſs. In taking this reſolution, which might probably be attended with the moſt important conſequences, he was deſirous to learn the will of heaven concerning the iſſue of the war. The principal oracles which he conſulted were thoſe of Branchis in Ionia, of Hammon in Libya, and of Delphi in Greece. Among theſe reſpected ſhrines, the oracle of Delphi maintained its aſcendant, as the moſt faithful interpreter of fate. Crœſus was fully perſuaded of its veracity; and deſirous generouſly to compenſate for the trouble which he had already given, and ſtill meant to give, the prieſts of Apollo, he ſacrificed 3000 oxen to the god, and adorned his ſhrine with dedications equally valuable for the workmanſhip and for the materials; precious veſſels of ſilver, ewers of iron beautifully inlaid and enamelled; various ornaments of pure gold, particularly a golden lion weighing ten talents, and a female figure three cubits or near five feet high. In return for theſe magnificent preſents, the oracle, in ambiguous language, flattered Crœſus with obtaining an eaſy victory over his enemies, and with enjoying a long life and a proſperous reign. The god at the ſame time enjoined him to contract an alliance with the moſt powerful of the Grecian ſtates.

Elevated with theſe favourable predictions of Apollo, Crœſus prepared to yield a ready obedience to the only condition required on his part for the accompliſhment of his aſpiring purpoſe. Not deeming himſelf ſufficiently acquainted with the affairs of Greece, to know what particular republic was meant by the oracle, he made particular inquiry of thoſe beſt informed concerning the ſtate of Europe; and diſcovered, that among all the members of the Grecian confederacy, the Athenians and Lacedemonians were juſtly intitled to the pre-eminence. In order to learn which of theſe communities deſerved the epithet of *moſt powerful*, it was neceſſary to ſend ambaſſadors into Greece. The Lydians diſpatched with this important commiſſion, ſoon diſcovered that the Athenians, after having been long haraſſed by internal diſſenſions, were actually governed by the tyrant Piſiſtratus. The Spartans, on the other hand, though anciently the worſt regulated of all the Grecian communities, had enjoyed domeſtic peace and foreign proſperity ever ſince they had adopted the wiſe inſtitutions of Lycurgus. After that memorable period, they had repeatedly conquered the warlike Argives, triumphed over the hardy Arcadians; and notwithſtanding the heroic exploits of Ariſtomenes, ſubdued and enſlaved their unfortunate rivals of Meſſene. To the Lydian ambaſſadors, therefore, the Spartan republic appeared to be pointed out by the oracle as the community whoſe alliance they were enjoined to ſolicit. Having repaired accordingly to Sparta, they were introduced not only to the kings and ſenate, but, as the importance of the negociation required, to the general aſſembly of the Lacedemonians, to whom they, in few words, declared the object of their commiſſion: "We are ſent, O Lacedemonians! by Crœſus, king of the Lydians and of many other nations, who being commanded by the oracle of Apollo to ſeek the friendſhip of the moſt powerful people of Greece, now ſummons you, who juſtly merit that epithet, to become his faithful allies, in obedience to the will of the god whoſe authority you acknowledge." The Lacedemonians, pleaſed with the alliance of a warlike king, and ſtill more with the fame of their valour, readily accepted the propoſal. To the ſtrict connection of an offenſive and defenſive league, they joined the more reſpected ties of ſacred hoſpitality. A few years before this tranſaction, they had ſent to purchaſe gold at Sardis for making a ſtatue of Apollo. Crœſus had on that occaſion gratuitouſly ſupplied their want. Remembering this generoſity, they gave the Lydian ambaſſadors at their departure, as a preſent for their maſter, a veſſel of braſs containing 300 amphoras (above 12 hogſheads), and beautifully carved on the outſide with various forms of animals. Lydia.

Crœſus, having thus happily accompliſhed the deſign recommended by the oracle, was eager to ſet out upon his intended expedition. He had formerly entered into alliance with Amaſis king of Egypt, and Labynetus king of Babylon. He had now obtained the friendſhip of the moſt warlike nation of Europe. The newly-raiſed power of Cyrus and the Perſians ſeemed incapable of reſiſting ſuch a formidable confederacy.

Elevated with theſe flattering ideas of his own invincible greatneſs, Crœſus waited not to attack the Perſian dominions until he had collected the ſtrength of his allies. The ſanguine impetuoſity of his temper, unexperienced in adverſity, unfortunately precipitated him into meaſures no leſs ruinous than daring. Attended only by the arms of Lydia, and a numerous band of mercenaries, whom his immenſe wealth enabled him at any time to call into his ſervice, he marched towards the river Halys; and having croſſed with much difficulty that deep and broad ſtream, entered the province of Cappadocia, which formed the weſtern frontier of the Median dominions. That unfortunate country ſoon experienced all the calamities of invaſion. The Pterian plain, the moſt beautiful and the moſt fertile diſtrict of Cappadocia, was laid waſte; the ports of the Euxine, as well as ſeveral inland cities, were plundered; and the inoffenſive inhabitants were either put to the ſword or dragged into captivity. Encouraged by the unreſiſting ſoftneſs of the natives of thoſe parts, Crœſus was eager to puſh forwards; and if Cyrus did not previouſly meet him in the field, he had determined to proceed in triumph to the mountains of Perſia. Againſt this dangerous reſolution he was in vain exhorted by a Lydian named Sandanis; who, when aſked his opinion of the war, declared it with that freedom which the princes of the Eaſt have in every age permitted, amidſt all the pride and caprices of deſpotic power, to men diſtinguiſhed by the gifts of nature or education. "You are preparing, O king, to march againſt a people who lead a laborious and a miſerable life; whoſe daily ſubſiſtence is often denied them, and is always ſcanty and precarious; who drink only water, and who are clothed with the ſkins of wild beaſts. What can the Lydians gain by the conqueſt of Perſia; they who enjoy all the advantages of which the Perſians are deſtitute? For my part, I deem it a bleſſing of the gods, that they have not excited the warlike poverty of theſe miſerable barbarians to invade and plunder the luxurious wealth of Lydia." The moderation of this advice was rejected by the fatal preſumption of Crœſus; who confounding

Lydia. the dictates of experienced wiſdom with the mean ſuggeſtions of puſillanimity, diſmiſſed the counſellor with contempt.

Meanwhile, the approach of Cyrus, who was not of a temper to permit his dominions to be ravaged with impunity, afforded the Lydian king an opportunity of bringing the war to a more ſpeedy iſſue than by his intended expedition into Perſia. The army of Cyrus gradually augmented on his march; the tributary princes cheerfully contributing with their united ſtrength towards the aſſiſtance of a maſter whoſe valour and generoſity they admired, and who now took arms to protect the ſafety of his ſubjects, as well as to ſupport the grandeur of his throne. Such was the rapidity of his movement, eſpecially after being informed of the deſtructive ravages of the enemy in Cappadocia, that he arrived from the ſhores of the Caſpian to thoſe of the Euxine Sea before the army of Crœſus had provided the neceſſaries for their journey. That prince, when appriſed of the neighbourhood of the Perſians, encamped on the Pterian plain; Cyrus likewiſe encamped at no great diſtance: frequent ſkirmiſhes happened between the light troops; and at length a general engagement was fought with equal fury and perſeverance, and only terminated by the darkneſs of night. The loſs on both ſides hindered a renewal of the battle. The numbers, as well as the courage of the Perſians, much exceeded the expectation of Crœſus. As they diſcovered not any intention to haraſs his retreat, he determined to move back towards Sardis, to ſpend the winter in the amuſements of his palace; and after ſummoning his numerous allies to his ſtandard, to take the field early in the ſpring with ſuch increaſe of force as ſeemed ſufficient to overpower the Perſians.

But this deſign was defeated by the careful vigilance of Cyrus. That experienced leader allowed the enemy to retire without moleſtation; carefully informing himſelf of every ſtep which they took, and of every meaſure which they ſeemed determined to purſue. Patiently watching the opportunity of a juſt revenge, he waited until Crœſus had re-entered his capital, and had diſbanded the foreign mercenaries, who compoſed the moſt numerous diviſion of his army. It then ſeemed the proper time for Cyrus to put his Perſians in motion; and ſuch was his celerity, that he brought the firſt news of his own arrival in the plain of Sardis. Crœſus, whoſe firmneſs might well have been ſhaken by the imminence of this unforeſeen danger, was not wanting on the preſent occaſion to the duties which he owed to his fame and the luſtre of the Lydian throne. Though his mercenaries were diſbanded, his own ſubjects, who ſerved him from attachment, who had been long accuſtomed to victory, and who were animated with a high ſenſe of national honour, burned with a deſire of enjoying an opportunity to check the daring inſolence of the invaders. Crœſus indulged and encouraged this generous ardour. The Lydians in that age fought on horſeback, armed with long ſpears; the ſtrength of the Perſians conſiſted in infantry. They were ſo little accuſtomed to the uſe of horſes, that camels were almoſt the only animals which they employed as beaſts of burden. This circumſtance ſuggeſted to a Mede, by name Harpagus, a ſtratagem, which being communicated to Cyrus, was immediately adopted with approbation by that prince. Harpagus, having obſerved that horſes had a ſtrong averſion to the ſhape and ſmell of camels, adviſed the Perſian army to be drawn up in the following order: All the camels which had been employed to carry baggage and proviſions were collected into one body, arranged in a long line fronting the Lydian cavalry. The foot ſoldiers of the Perſians were poſted immediately behind the line, and placed at a due diſtance. The Median horſe (for a few ſquadrons of theſe followed the ſtandard of Cyrus) formed the rear of the army. As the troops on both ſides approached to join battle, the Lydian cavalry, terrified at the unuſual appearance of the camels, mounted with men in arms, were thrown into diſorder, and turning their heads, endeavoured to eſcape from the field. Crœſus, who perceived the confuſion, was ready to deſpair of his fortune; but the Lydians, abandoning their horſes, prepared with uncommon bravery to attack the enemy on foot. Their courage deſerved a better fate; but unaccuſtomed as they were to this mode of fighting, they were received and repelled by the experienced valour of the Perſian infantry, and obliged to take refuge within the fortified ſtrength of Sardis, where they imagined themſelves ſecure. The walls of that city bid defiance to the rude art of attack, as then practiſed by the moſt warlike nations. If the Perſian army ſhould inveſt it, the Lydians were provided with proviſions for ſeveral years; and there was reaſon to expect, that in a few months, and even weeks, they would receive ſuch aſſiſtance from Egypt, Babylonia, and Greece (to which countries they had already ſent ambaſſadors), as would oblige the Perſians to raiſe the ſiege.

The Lydian miniſters diſpatched into Greece met with great ſympathy from the Spartans. That people were particularly obſervant of the faith of treaties; and while they puniſhed their enemies with unexampled ſeverity, they behaved with generous compaſſion towards thoſe whom they had once accepted for allies. They immediately reſolved therefore to ſend him a ſpeedy and effectual relief; and for this purpoſe aſſembled their troops, made ready their veſſels, and prepared every thing neceſſary for the expedition.

The valour of the Spartans might perhaps have upheld the ſinking empire of Lydia; but before their armament could ſet ſail, Crœſus was no longer a ſovereign. Notwithſtanding the ſtrength of Sardis, that city had been taken by ſtorm on the 20th day of the ſiege; the walls having been ſcaled in a quarter which, appearing altogether inacceſſible, was too careleſsly guarded. This was effected by the enterpriſe of Hyreades a Mede, who accidentally obſerved a centinel deſcend part of the rock in order to recover his helmet. Hyreades was a native of the mountainous province of Mardia, and being accuſtomed to clamber over the dangerous precipices of his native country, reſolved to try his activity in paſſing the rock upon which he had diſcovered the Lydian. The deſign was more eaſily accompliſhed than he had reaſon to expect: emulation and ſucceſs encouraged the braveſt of the Perſians to follow his example; theſe were ſupported by greater numbers of their countrymen; the garriſon of Sardis was ſurpriſed; the citadel ſtormed;

Lydiat ‖ Lygii

the rich capital of Lower Aſia ſubjected to the vengeful rapacity of an indignant victor. Thus ended the ancient kingdom of Lydia, which continued ſubject to the Perſians till they alſo were conquered by the Macedonians.—For the fate of the Lydian monarch, ſee the article CROESUS.

LYDIAT (Thomas), a learned Engliſh divine, born in 1572, and educated at Oxford. About the year 1609, he became acquainted with Dr James Uſher, afterwards archbiſhop of Armagh, who carried him to Ireland. He was at Dublin college for about two years, after which he returned to England; and the rectory of Alkrington becoming vacant, he was preſented to it: but at length, being engaged for the debts of a near relation, which for the preſent he was unable to pay, having before ſpent his patrimony in printing ſeveral books, he was ſent to priſon; and was confined at Oxford, in the King's-bench, and elſewhere, till Sir William Boſwell, a generous patron of learned men, Dr Robert Pink, warden of New-college, biſhop Uſher, and Dr Laud, diſcharged the debt. In the civil wars, he ſuffered much in his rectory of Alkrington from the parliament-party; was four times pillaged to the value of at leaſt 70l.; and was forced for a quarter of a year together to borrow a ſhirt to ſhift himſelf. He died in 1646. He wrote ſome pieces in Engliſh, and many works in Latin, on chronology and natural hiſtory.

LYDIUS LAPIS, in the natural hiſtory of the ancients; the name of the ſtone uſed by way of touchſtone for the trial of gold and ſilver, and called by ſome *Heraclius lapis*; both of which names were alſo applied by the ancients to the load-ſtone; and hence has ariſen no ſmall miſunderſtanding of their works. Pliny has obſerved, that both the load-ſtone and touch-ſtone were at times called *Lydius* and *Heraclius lapis*.

The true *lapis Lydius*, or the touchſtone, was anciently found only in the river Tmolus; but was afterwards found in many other places, and is now very common in many of the German rivers. The ancients give us very remarkable and circumſtantial accounts of the uſes they made of it; and it is plain they were able to diſcern the alloys of gold by means of it with very great exactneſs. We at preſent uſe ſeveral different ſtones under this name, and for the ſame purpoſe. In Italy, a green marble called *verdello*, is moſt frequently uſed; and with us, very frequently ſmall pieces of the *baſaltes*, the ſame with that vaſt piece of black marble called the *Giant's Cauſeway* in Ireland. See BASALTES; *GIANT's Cauſeway*; ICELAND, n° 5; STAFFA; and VOLCANO.

LYGEUM, in botany: a genus of the monogynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the fourth order, *Gramina*. The ſpatha or ſheath is monophyllous; there are a pair of corollæ upon the ſame germen; the nut is bilocular.

LYGII, LIGII, *Lugii*, or *Logiones* (anc. geog.), a people of Germany, to the weſt of the Viſtula, where it forms a bend like a creſcent; *Ligii*, (Dio); *Lugii*, (Strabo); *Logiones*, (Zoſimus). Their name *Lugii* is conjectured to be derived from their mutually cloſe confederacy or league. The Viſtula was their boundary to the north, eaſt, and ſouth, with mount Aſciburgius to the weſt. Now the whole of that country lies in Poland, on this ſide the Viſtula.

Lying-in-women ‖ Lymington.

LYING-IN-WOMEN. See MIDWIFERY.

LYING-To, or *Lying-By*, the ſituation of a ſhip, when ſhe is retarded in her courſe, by arranging the ſails in ſuch a manner as to counteract each other with nearly an equal effort, and render the ſhip almoſt immoveable, with reſpect to her progreſſive motion, or head-way. A ſhip is uſually brought-to by the main and fore-top ſails, one of which is laid aback, whilſt the other is full; ſo that the latter puſhes the ſhip forward, whilſt the former reſiſts this impulſe by forcing her aſtern. This is particularly practiſed in a general engagement, when the hoſtile fleets are drawn up in two lines of battle oppoſite each other. It is alſo uſed to wait for ſome other ſhip, either approaching or expected; or to avoid purſuing a dangerous courſe, eſpecially in dark or foggy weather, &c.

LYME-REGIS a ſea-port town of Dorſetſhire in England, 148 miles from London. It lies near the ſea, on the very borders of Devonſhire, in a cavity between two rocky hills, which makes it difficult of acceſs. It is about five furlongs long, and contains about 200 houſes. As it lies on the declivity of a hill, the houſes make a good ſhow, one above another; and ſome of them are built of free-ſtone, and covered with blue ſlate. The corporation conſiſts of a mayor (who is juſtice of peace during his mayoralty and the year after, and in the third year both juſtice and coroner), a recorder, 15 capital burgeſſes, and a town-clerk. This place had formerly a very flouriſhing trade to France, Spain, the Straits, Newfoundland, and the Weſt Indies; during which, the cuſtoms amounted ſome years to 16,000l. But it ſtands on ſuch a high ſteep rock, that the merchants are obliged to load and unload their goods at a place a quarter of a mile off, called the *Cobb*, originally built in the reign of Edward III. which coſts a great ſum to maintain, but forms ſuch a harbour as perhaps is not to be equalled in the world, the ſhips being ſheltered by a high thick ſtone wall, raiſed in the main ſea a good way from the ſhore, broad enough for carriages and warehouſes, and the cuſtom-houſe officers have one upon it. The cellars of the low part of the town, near the ſea, are however often overflowed by the ſpring-tides 10 or 12 feet. There are guns planted for defence both of the Cobb and the town, the ſhore here being very proper for batteries. The cuſtom-houſe ſtands on pillars, with the corn-market under it. There is an alms-houſe in church-ſtreet, alſo Preſbyterian and Anabaptiſt meeting-houſes. The town-hall is near Broad-ſtreet. The church ſtands at the eaſt end of the town on a riſing ground. The market here is Friday, and there are two fairs in the year. We read, that, in 774, the Saxon King Kinwulf gave land hereabouts to the church of Sherborn, for the boiling of ſalt there to ſupply its neceſſities. At this place the duke of Monmouth landed in 1685. A few years ago above 2000l. worth of gold and ſilver coin of Char. I. and II. were diſcovered by ſome labourers.

LYMINGTON, a borough-town of Hampſhire in England, 97 miles ſouth-weſt of London. It ſtands about a mile from the channel, running between the main land and the iſle of Wight; and has a harbour for

Lymph ‖ Lyncurius.

for veſſels of conſiderable burden. The tide flows near a mile above the town. It has a market on Saturdays, and two fairs in the year; and ſends two members to parliament.

LYMPH, a fine colourleſs fluid, ſeparated in the body from the maſs of blood, and contained in peculiar veſſels called *lymphatics*. See ANATOMY.

LYMPHATI, was a name given by the Romans to ſuch as were ſeized with madneſs. It is ſuppoſed to be uſed for *Nymphati*, becauſe the ancients imagined that every perſon who had the misfortune to ſee a nymph was inſtantly ſtruck with phrenzy. *Lymphati* may indeed ſignify "madmen," as derived from *lympha*, "water," over which element the nymphs were thought to preſide: But it appears moſt likely, that diſtracted people were called *lymphati*, from the circumſtance of madmen's being affected with the *hydrophobia* or dread of water after the bite of a mad dog; for this peculiarity, in caſes of canine madneſs, was not unknown to the Romans.

LYNCEUS, in fabulous hiſtory, one of the 50 ſons of Ægeus, married Hypermneſtra, one of the 50 daughters of Danaus. See HYPERMNESTRA.

LYNCEUS, in fabulous hiſtory, one of the Argonauts, who went with Jaſon in the expedition to obtain the golden fleece. He was of great uſe to the Argonauts, by enabling them to avoid the ſand-banks and rocks they found in their way. The poets ſay, that Lynceus had ſo piercing a ſight, that it could not only penetrate to the bottom of the ſea, but even to hell. Some mythologiſts ſuppoſe, that this fable is taken from Lynceus's ſkill in obſerving the ſtars, and diſcovering the mines of gold and ſilver concealed in the earth.

LYNCURIUM, a ſtone thought to be the ſame with the tourmalin. The name is derived from λυγξ, "lynx," and ουρον, "urine."

LYNCURIUS LAPIS, a ſtone capable of producing muſhrooms.

In the Ephemerides of the Curious we find mention made of a ſtone, ſo called by Dr John George Wolckamerus, who ſaw one in Italy, which never ceaſes to produce in a few days muſhrooms of an excellent flavour by the moſt ſimple and eaſy proceſs imaginable. "It is (ſays he) of the bigneſs of an ox's head, rough and uneven on its ſurface, and on which alſo are perceived ſome clefts and crevices. It is black in ſome parts, and in others of a lighter and greyiſh colour. Internally it is porous, and nearly of the nature of the pumice-ſtone, but much heavier; and it contains a ſmall piece of flint, which is ſo incorporated with it as to appear to have been formed at the ſame time the ſtone itſelf received its form. This gives room to judge, that thoſe ſtones have been produced by a fat and viſcid juice, which has the property of indurating whatever matter it filtrates into. The ſtone here ſpoken of, when it has been lightly covered with earth, and ſprinkled with warm water, produces muſhrooms of an exquiſite flavour, which are uſually round, ſometimes oval, and whoſe borders, by their inflexions and different curvities, repreſent in ſome meaſure human ears. The principal colour of theſe muſhrooms is ſometimes yellowiſh, and ſometimes of a bright purple; but they are always diſſeminated with different ſpots, of a deep orange colour, or red brown; and when theſe ſpots are recent, and ſtill in full bloom, they produce a very agreeable effect to the ſight. But what appears admirable is, that the part of the ſtalk which remains adhering to the ſtone, when the muſhroom has been ſeparated from it, grows gradually hard, and petrifies in time, ſo that it ſeems that this fungites reſtores to the ſtone the nutritive juice it received from it, and that it thus contributes to its increaſe." John Baptiſt Porta pretends, that this ſtone is found in ſeveral parts of Italy; and that it is not only to be met with at Naples, taken out of mount Veſuvius, but alſo on mount Pantherico, in the principality of Arellino; on mount Garganus, in Apulia; and on the ſummit of ſome other very high mountains. He adds, that the muſhrooms which grow on thoſe ſorts of ſtones, and are uſually called *fungi lyncurii*, have the property of diſſolving and breaking the ſtone of the kidneys and bladder; and that, for this purpoſe, nothing more is required than to dry them in the ſhade, and being reduced to powder, to make the patient, faſting, take a ſufficient quantity of this powder in a glaſs of white-wine, which will ſo cleanſe the excretory ducts of the urine, that no ſtones will ever after be collected in them. As to the form of thoſe muſhrooms, their root is ſtony, uneven, divided according to its longitudinal direction, and compoſed of fibres as fine as hairs, interwoven one with another. Their form, on firſt ſhooting out, reſembles a ſmall bladder, ſcarce then larger than the bud of a vine; and if in this ſtate they are ſqueezed between the fingers, an aqueous ſubacid liquor iſſues out. When they are at their full growth, their pedicle is of a finger's length, larger at top than at bottom, and becomes inſenſibly ſlenderer in proportion as it is nearer the earth. Theſe muſhrooms are alſo formed in an umbella, and variegated with an infinity of little ſpecks ſituated very near one another. They are ſmooth and even on the upper part, but underneath leafy like the common muſhrooms. Their taſte is likewiſe very agreeable, and the ſick are not debarred eating of them when they have been dreſſed in a proper manner. Curioſity having prompted ſome naturaliſts and phyſicians to ſubmit theſe ſtones to a chemical analyſis, in order to be more competent judges of the uſes they might be put to in medicine, there firſt came forth, by diſtillation, an inſipid water, and afterwards a ſpirituous liquor. The retort having been heated to a certain point, there aroſe an oil, which had nearly the ſmell and taſte of that of guaiacum; and a very acrid ſalt was extracted from the aſhes.

Lyncurius, Lynn-regis.

LYNN-REGIS, a town of Norfolk, in England, diſtant 98 miles from London. It is a handſome, large, well-built place, and ſends two members to parliament. It was a borough by preſcription in 1298. King John, on account of its adherence to him againſt the barons, made it a free borough, with large privileges. He appointed it a provoſt, and gave it a large ſilver cup of 73 ounces doubly gilt and enamelled, and a large ſilver ſword that is carried before the mayor; though this laſt, according to ſome, is Henry VIII.'s ſword, which he gave to the town when it came into his hands by exchange with the biſhop of Norwich; after which it was called King's Lynn, whereas before it was Biſhop's Lynn. Henry III. made it a mayor-town, for its ſerving him againſt the barons.

Lynn-regis

It has had 15 royal charters; and is governed by a mayor, high-ſteward, under-ſteward, recorder, 12 aldermen, and 18 common-council men. It has two churches, beſides St Nicholas, a chapel of eaſe to St Margaret's, a preſbyterian and a quakers meeting-houſe, with a bridewell or workhouſe, and ſeveral alms-houſes, and a free-ſchool. In September 1741 the ſpires of its two churches were both blown down by a ſtorm of wind; and that of St Margaret's, which was 193 feet in height, having beat in the body of the church, it has been ſince rebuilt, towards which king George II. gave L. 1000, and the late earl of Orford, then Sir Robert Walpole, L. 500. This church was formerly an abbey, and afterwards one of the largeſt pariſh-churches in England. The town-houſe, called Trinity-hall, is a noble old fabric; and ſo is the Exchange, which is of free-ſtone, with two orders of columns. St Nicholas's chapel is very ancient, and reckoned one of the faireſt and largeſt of the kind in England. It has a bell-tower of free-ſtone, and an eight-ſquare ſpire over it, both which together are 170 feet from the ground. There is a library in it that was erected by ſubſcription; and there is another at St Margaret's. Here have been formerly ſeveral monaſteries; but the only fabric remaining that belongs to any religious order is the Grey-friars ſteeple, a noted ſea-mark. The ſituation of this town, near the fall of the Ouſe into the ſea, after having received ſeveral other rivers, of which ſome are navigable, gives it an opportunity of extending its trade into eight different counties; by which many conſiderable cities and towns, viz. Peterborough, Ely, Stamford, Bedford, St Ives, Huntingdon, St Neot's, Northampton, Cambridge, St Edmundſbury, and the north part of Bucks, as well as the inland parts of Norfolk and Suffolk, are ſupplied with heavy goods, not only from our own produce, as coals and ſalt from Newcaſtle, but alſo of merchandize imported from abroad, eſpecially wine; of which two articles, viz. coals and wine, this is the greateſt port for importation of any place on all the eaſtern coaſt of England; and thoſe wherein the Lynn merchants deal more largely than any town in England, except London, Briſtol, and Newcaſtle. In return for this, Lynn receives back all the corn which the counties juſt mentioned produce, for exportation; and therefore ſends more of it abroad than any port except Hull. The foreign trade of the merchants here is very conſiderable, eſpecially to Holland, Norway, and the Baltic, and alſo to Spain and Portugal; and formerly they drove a good trade to France, till it was turned off, by treaties on one hand, and by prohibitions, high duties, &c. on the other, to Spain and Portugal. The harbour is ſafe when ſhips are in it, but difficult to enter by reaſon of the many flats and ſhoals in the paſſage; which, however, are well buoyed, and good pilots are always ready. The town conſiſts of about 2400 houſes; and appears to have been very ſtrong, by the ruins of the works demoliſhed in the civil wars. St Ann's platform at the north end mounts 12 great guns, and commands all the ſhips paſſing near the harbour; and towards the land, beſides the wall, there is a ditch. Four rivulets run through the town; and the tide of the Ouſe, which is about as broad here as the Thames at London-bridge, riſes 20 feet perpendicular. In the great market-place a ſtatue was erected in 1686 to the honour of king James II. There is another ſpacious market-place, adorned with a ſtatue of king William III. and a fine croſs with a dome and gallery round it ſupported by 16 pillars. The market-houſe is of free-ſtone, ſupported by 16 columns; and is 70 feet high, erected on four ſteps, neatly adorned with ſtatues, &c. Every firſt Monday in the month, the mayor, aldermen, preachers, &c. meet to hear and determine all controverſies amicably, for preventing law-ſuits. This was firſt eſtabliſhed in 1588, and is called *The Feaſt of Reconciliation*. The markets are on Tueſdays and Saturdays; and it has two fairs: one of which, beginning Feb. 14. laſts for a fortnight, and is called Lynn-mart; the other is a cheeſe-fair on Oct. 6. The adherence of this town to king John and to Henry VIII. as above mentioned, are not the only inſtances of its loyalty to its ſovereigns; for, in the late civil wars, it held out for king Charles I. and ſuſtained a formal ſiege of above 18,000 men of the parliament-army, for above three weeks; but, for want of relief, was obliged to ſurrender, and ſubmit to the terms of paying 10s. a-head for every inhabitant, and a month's pay to the ſoldiers, to ſave the town from plunder. There are more gentry, and conſequently more gaiety, in this town than in Yarmouth or even Norwich; there being ſuch plenty of eatables and drinkables, that Spelman ſays Ceres and Bacchus ſeem to have eſtabliſhed their magazines at this place; the eaſt ſide abounding with corn, ſheep, rabbits, hares, &c. the weſt ſide with cheeſe, butter, black-cattle, ſwans, and the wild-fowl common to marſhes, beſides the abundance of ſea and river fiſh; ſo that he thinks there is no place in Great Britain, if in Europe, has ſuch a variety in ſo ſmall a compaſs of ground. At a ſmall diſtance from the town ſtands a mount called the Lady's or Red Mount, where was once a chapel dedicated to the Virgin Mary, which was a reſting-place for pilgrims on their way towards her convent at Walſingham. The king's ſtaith-yard, or quay, where the greateſt part of the imported wines is landed and put into large vaults, is a handſome ſquare, with brick buildings, in the centre whereof is a ſtatue of king James I. People paſs hence into the fen-country, and over the famous waſhes into Lincolnſhire in boats, which are often loſt, by venturing out at an improper ſeaſon and without guides.

Lynn-regis ‖ Lyon.

LYNX, in zoology. See FELIS.

LYON *King of Arms*. See KING; and LAW, n° clviii. 16.

This office is of great antiquity and reſpect in Scotland; and although the preciſe time of its inſtitution is unknown, yet it muſt have been as early as the introduction of armorial figures as hereditary marks of gentility and diſtinction into this country, which was in the 12th century. His regalia are, a crown of gold, with a crimſon velvet-cap, a gold taſſel, and an ermine lining; a velvet-robe reaching to his feet, with the arms of the kingdom embroidered thereon before and behind in the proper tinctures; a triple row of gold chain round his neck, with an oval gold medal pendent thereto, on one ſide of which is the royal bearing, and on the other St Andrew with his croſs enamelled in proper colours, and a baton of gold enamelled green, pow-

Lyonet.

dered with the badges of the kingdom. The Lord Lyon's rank is ſuperior to that of any other king of arms, as he holds his office immediately from the ſovereign by commiſſion under the great ſeal; whereas the kings of arms in England are deputies to the Earl Marſhal, and act under his authority. Formerly Scotland was divided into two provinces, the one on the north and the other on the ſouth ſide of Forth; and theſe provinces were under the management of two deputies appointed by the Lord Lyon to ſuperintend the execution of all the buſineſs of his office. Before the revolution, the Lord Lyon, at his admiſſion into office, was moſt ſolemnly crowned by the ſovereign or his commiſſioner, in preſence of the nobility, the officers of ſtate, and other great men, after a ſuitable ſermon preached in the royal chapel; and his crown was of the ſame form with the imperial crown of the kingdom. On ſolemn occaſions he wears the regalia above deſcribed; at all other times, he wears the oval gold medal or badge on his breaſt, ſuſpended by a broad green ribbon. He has the abſolute diſpoſal of all the offices in his own court, and of the heralds and purſuivants places. The meſſengers at arms throughout Scotland are alſo created by him, and are amenable to his juriſdiction. And the powers veſted in him by his commiſſion are the ſame with thoſe of the ſovereign in all matters relative to the marks of gentility.

LYONET (Peter), an ingenious naturaliſt, and member of ſeveral learned ſocieties, was born at Mæſtricht, and was deſcended from a very ancient and reſpectable family of Lorrain. He had ſcarcely attained his ſeventh year before he diſplayed an uncommon ſtrength and agility in all bodily exerciſes; but he was not leſs diligent in the improvement of his mind. Being placed at the Latin ſchool, he learned chronology, and exerciſed himſelf in Latin, Greek, and French poetry, as alſo in Hebrew, logic, and the Carteſian Phyſics. He was particularly fond of the ſtudy of languages, whereof he underſtood no leſs than nine, living and dead. Having entered the univerſity of Leyden, he ſtudied the Newtonian philoſophy, geometry, algebra, &c.; but his father (who was a clergyman), deſiring he ſhould attach himſelf to divinity, he reluctantly abandoned the former ſtudies, as his paſſion for them was not eaſily to be overcome. He at the ſame time applied himſelf to anatomy, and alſo to muſic and drawing. He began afterwards to practiſe ſculpture: and performed ſeveral pieces in wood, ſome of which are preſerved, and have been greatly admired by the artiſts. After this, he betook himſelf to drawing portraits of his friends from life; wherein, after three or four months practice, he became a great proficient. Having attained the degree of candidate in divinity, he reſolved to ſtudy law, to which he applied himſelf with ſo much zeal, that he was promoted at the end of the firſt year. Arrived at the Hague, he undertook the ſtudy of decyphering; and became ſecretary of the cyphers, tranſlator of the Latin and French languages, and patent-maſter, to their High Mightineſſes. Meanwhile, having taken a ſtrong liking to the ſtudy of inſects, he undertook an hiſtorical deſcription of ſuch as are found about the Hague, and to that end collected materials for ſeveral volumes; and having invented a method of drawing adapted thereto, he enriched this work with a great number of plates, univerſally admired by all the connoiſſeurs who had ſeen them. In the year 1742 was printed at the Hague a French tranſlation of a German work, the 'Theology of Inſects,' by Mr Leſſer. Love of truth engaged Mr Lyonet to defer the publication of his above-mentioned deſcription, and to make ſome obſervations on that work, to which he has added two moſt beautiful plates, engraved from his deſigns. This performance cauſed his merit to be univerſally known and admired. The celebrated M. de Reaumur had the above tranſlation reprinted at Paris, not ſo much on account of the work itſelf as of Mr Lyonet's obſervations; and beſtowed on it, as did alſo many other authors, the higheſt encomiums. He afterwards executed drawings of the freſh-water polypus for Mr Trembley's beautiful work, 1744. The ingenious Wandelaar had engraved the firſt five plates; when Mr Lyonet, who had never witneſſed this operation, concerned at the difficulties he experienced in getting the remaining eight finiſhed in the ſuperior ſtyle he required, reſolved to perform the taſk himſelf. He accordingly took a leſſon of one hour of Mr Wandelaar, engraved three or four ſmall plates, and immediately began upon the work itſelf, which he performed in ſuch a manner as drew on him the higheſt degree of praiſe, both from Mr Trembley and from many other artiſts, particularly the celebrated Van Gool; who declared that the performance aſtoniſhed not only the amateurs, but alſo the moſt experienced artiſts. In 1748 he was choſen member of the Royal Society of London. In 1749 he began (by mere chance) his amazing collection of horns and ſhells, which, according to the univerſal teſtimony of all travellers and amateurs who have viſited it, is at preſent the moſt beautiful, and certainly one of the moſt valuable, in Europe. In 1753 he became member of the newly-eſtabliſhed Dutch Society of Sciences at Haerlem; and in 1757, after the celebrated M. le Cat, profeſſor in anatomy and ſurgery, and member of almoſt all the principal ſocieties in Europe, had ſeen Mr Lyonet's incomparable *Traité Anatomique de la Chenille qui ronge le Bois de Saule*, with the drawings belonging to it (which work was afterwards publiſhed), he was elected member of the Royal Academy of Sciences of Rome, whereof M. le Cat was perpetual ſecretary. After the publication of this treatiſe, he became, in 1760, member of the Royal Academy of Sciences of Berlin; in 1761, of the Imperial Academy of Naturaliſts; and, in 1762, of the Imperial Academy of Sciences at St Peterſburg. In order to enable ſuch as might be deſirous of following him in his intricate and moſt aſtoniſhing diſcoveries reſpecting the ſtructure of this animal, Mr Lyonet publiſhed, in the 'Tranſactions of the Dutch Society of Sciences at Haerlem,' a deſcription and a plate (as he alſo afterwards did in French at the beginning of his *Traité Anatomique*) of the inſtrument and tools he had invented for the purpoſe of diſſection, and likewiſe of the method he uſed to aſcertain the degree of ſtrength of his magnifying glaſſes. Notwithſtanding all this labour, which was conſiderably increaſed by the extenſive correſpondence which he for many years carried on with ſeveral learned and reſpectable perſonages, he ſtill found means to fet-

Lyonois || Lyre.

set apart a large proportion of his time (as he himself mentions it in his preface) for the immediate service of his country; but was not fortunate enough (as appears by his writings) to get any other recompense for his exertions than sorrow and disappointment.—During the last fifteeen or twenty years of his life, Mr Lyonet added to the valuable treasure he had already collected of natural curiosities, a most superb cabinet of paintings, consisting of more than 560 performances; among which are many of the most eminent works of the first Dutch masters. He did this with a view to procure himself some amusement during the latter part of his life, when old age and infirmities must weaken his powers, and set bounds to his activity. He had always indeed accustomed himself to employment, insomuch that he has written some pieces of Dutch poetry; and this disposition remained with him till within a fortnight of his death, when he was attacked with an inflammation in his breast, which, though apparently cured, was, in the end, the cause of his dissolution. He died at the Hague in January 1789, aged 83 years, leaving behind him a most estimable character.

LYONOIS, a large province of France; bounded on the north by Burgundy; on the east, by Dauphiny, Bresse, and the principality of Dombs; on the south, by Vivarais and Velay; and on the west, by Auvergne and a small part of Bourbonnois. It comprehends Lower Lyonnois, Beaujolois, and Forez; and it produces corn, wine, fruits, and more especially excellent chesnuts. The principal rivers are the Soane, the Rhone, and the Loire. Lyons is the capital town.

LYONS, a large, rich, handsome, ancient, and famous town of France, being the most considerable in the kingdom, next to Paris, with an archbishop's see, an academy of sciences and belles lettres, and an academy of arts and sciences settled here in 1736. It is seated in the centre of Europe, on the confluence of the rivers Rhone and Soan: on the side of it are two high mountains; and the mountain of St Sebastian serves as a bulwark against the north winds, which often blow here with great violence. It contains about 150,000 inhabitants; and the houses, in general, are high and well built. It has six gates, and as many suburbs. The town-house, the arsenal, the amphitheatre built by the ancient Romans, the hospital, and the numerous palaces, are worthy of a traveller's attention. The cathedral is a superb structure, and the canons that compose the chapter are all persons of distinction. It is a place of very great trade, which is extended not only through France, but to Italy, Switzerland, and Spain; and there are four celebrated fairs every year, which are frequented by great numbers of people. It derives vast advantages from the rivers it stands upon; and is situated in E. Long. 4. 55. N. Lat. 45. 46.

LYRA, in ichthyology. See CALLYONIMUS.

LYRA, in astronomy, a constellation in the northern hemisphere. The number of its stars, in Ptolemy's catalogue, is ten; in Tycho's eleven; in Hevelius's seventeen; and in the Britannic catalogue twenty-one.

LYRE, a musical instrument of the stringed kind, much used by the ancients.

Concerning the number of strings with which this instrument was furnished, there is great controversy. Some assert it to be only three; and that the sounds of the two remote were acute, and that of the intermediate one a mean between those two extremes: that Mercury, the inventor, resembled those three chords to as many seasons of the year, which were all that the Greeks reckoned, namely, Summer, Winter, and Spring: assigning the acute to the first, the grave to the second, and the mean to the third. Lyre.

Others assert that the lyre had four strings; that the interval between the first and the fourth was an octave; that the second was a fourth from the first, and the fourth the same distance from the third, and that from the second to the third was a tone.

Another class of writers contend that the lyre of Mercury had seven strings. Nicomachus, a follower of Pythagoras, and the chief of them, gives the following account of the matter: "The lyre made of the shell was invented by Mercury; and the knowledge of it, as it was constructed by him of seven strings, was transmitted to Orpheus: Orpheus taught the use of it to Thamyris and Linus; the latter of whom taught it to Hercules, who communicated it to Amphion the Theban, who built the seven gates of Thebes to the seven strings of the lyre." The same author proceeds to relate, "That Orpheus was afterwards killed by the Thracian women; and that they are reported to have cast his lyre into the sea, which was afterwards thrown up at Antissa, a city of Lesbos: that certain fishers finding it, they brought it to Terpander, who carried it to Egypt, exquisitely improved, and, showing it to the Egyptian priests, assumed to himself the honour of its invention."

This difference among authors seems to have arisen from their confounding together the Egyptian and the Grecian Mercuries.—The invention of the primitive lyre with three strings was due to the first Egyptian HERMES, as mentioned under that article.—The lyre attributed to the Grecian Mercury is described by almost all the poets to be an instrument of seven strings†. Vincenzio Galilei has collected the various opinions of the several Greek writers who have mentioned the invention of the chelys or testudo; and the late Mr Spence has done the same in a very circumstantial but ludicrous manner. "Horace talks of Mercury as a wonderful musician, and represents him with a lyre. There is a ridiculous old legend relating to this invention, which informs us, that Mercury, after stealing some bulls from Apollo, retired to a secret grotto, which he used to frequent, at the foot of a mountain in Arcadia. Just as he was going in, he found a tortoise feeding at the entrance of his cave: he killed the poor creature, and, perhaps, eat the flesh of it. As he was diverting himself with the shell, he was mightily pleased with the noise it gave from its concave figure. He had possibly been cunning enough to find out, that a thong pulled strait and fastened at each end, when struck by the finger, made a sort of musical sound. However that was, he went immediately to work, and cut several thongs out of the hides he had lately stolen, and fastened them as tight as he could to the shell of this tortoise; and, in playing with them, made a new kind of music with them to divert himself in his

† See Mercury.

Lyre. retreat." This, conſidered only as an account of the firſt invention of the lyre, is not altogether ſo unnatural.

The moſt ancient repreſentations of this inſtrument agree very well with the account of its invention: the lyre, in particular on the old celeſtial globes, was repreſented as made of one entire ſhell of a tortoiſe; and that Amphion in the celebrated group of the Dirce or Toro, in the Farneſe palace at Rome, which is of Greek ſculpture, and very high antiquity, is figured in the ſame manner.

There have, however, been many other claimants to the ſeven-ſtringed lyre. For though Mercury invented this inſtrument in the manner already related, it is ſaid he afterwards gave it to Apollo, who was the firſt that played upon it with method, and made it the conſtant companion of poetry. According to Homer's account of this tranſaction, in his hymn to Mercury, it was given by that god to Apollo, as a peace-offering and indemnification for the oxen which he had ſtolen from him:

To Phœbus Maia's ſon preſents the lyre,
A gift intended to appeaſe his ire.
The god receives it gladly, and eſſays
The novel inſtrument a thouſand ways;
With dext'rous ſkill the plectrum wields; and ſings,
With voice accordant to the trembling ſtrings,
Such ſtrains as gods and men approv'd, from whence
The ſweet alliance ſprung of ſound and ſenſe.

Diodorus informs us, that Apollo ſoon repenting of the cruelty with which he had treated Marſyas in conſequence of their muſical conteſt, broke the ſtrings of the lyre, and by that means put a ſtop for a time to any further progreſs in the practice of that new inſtrument. "The muſes (adds he) afterwards added to this inſtrument the ſtring called *meſe*; Linus, that of *lichanos*; and Orpheus and Thamyras, thoſe ſtrings which are named *hypate* and *parhypate* (A).

Again, many ancient and reſpectable authors tell us, that, before the time of Terpander, the Grecian lyre had only four ſtrings; and, if we may believe Suidas, it remained in this ſtate 856 years, from the time of Amphion, till Terpander added to it three new ſtrings, which extended the muſical ſcale to a heptachord, or ſeventh, and ſupplied the player with two conjoint tetrachords. It was about 150 years after this period, that Pythagoras is ſaid to have added an eighth ſtring to the lyre, in order to complete the octave, which conſiſted of two disjoint tetrachords.

Boethius gives a different hiſtory of the ſcale, and tells us, that the ſyſtem did not long remain in ſuch narrow limits as a tetrachord. Chorœbus, the ſon of Athis, or Atys, king of Lydia, added a fifth ſtring; Hyagnis, a ſixth; Terpander, a ſeventh; and, at length, Lychaon of Samos, an eighth. But all theſe accounts are irreconcileable with Homer's hymn to Mercury, where the chelys, or teſtudo, the invention of which he aſcribes to that god, is ſaid to have had ſeven ſtrings. There are many claimants among the muſicians of ancient Greece to the ſtrings that were afterwards added to theſe, by which the ſcale, in the time of Ariſtoxenus, was extended to two octaves. Athenæus, more than once, ſpeaks of the nine-ſtringed inſtrument; and Ion of Chios, a tragic and lyric poet and philoſopher, who firſt recited his pieces in the 82d olympiad, 452 B.C. mentions, in ſome verſes quoted by Euclid, the ten-ſtringed lyre; a proof that the third conjoint tetrachord was added to the ſcale in his time, which was about 50 years after Pythagoras is ſuppoſed to have conſtructed the octachord.

The different claimants among the Greeks to the ſame muſical diſcoveries, only prove, that muſic was cultivated in different countries; and that the inhabitants of each country invented and improved their own inſtruments, ſome of which happening to reſemble thoſe of other parts of Greece, rendered it difficult for hiſtorians to avoid attributing the ſame invention to different perſons. Thus the ſingle flute was given to Minerva and to Marſyas; the ſyrinx or fiſtula, to Pan and to Cybele; and the lyre or chithara, to Mercury, Apollo, Amphion, Linus, and Orpheus. Indeed, the mere addition of a ſtring or two to an inſtrument without a neck, was ſo obvious and eaſy, that it is ſcarce poſſible not to conceive many people to have done it at the ſame time.

With reſpect to the form of the ancient lyre, as little agreement is to be found among authors as about the number of ſtrings. The beſt evidences concerning it are the repreſentations of that inſtrument in the hands of ancient ſtatues, bas-reliefs, &c. See Plate CCLXXV. where,

Fig. 1. is a repreſentation of the teſtudo, or lyre of Amphion, in front, as it appears on the baſe of the celebrated Toro Farneſe at Rome. This admirable work, conſiſting of four figures bigger than the life, beſides the toro, or bull, was found in Caracalla's baths, where the Farneſe Hercules was likewiſe diſcovered: and, except

(A) It has been already related, that the lyre invented by the Egyptian Mercury had but three ſtrings; and by putting theſe two circumſtances together, Dr Burney obſerves, we may perhaps acquire ſome knowledge of the progreſs of muſic, or, at leaſt, of the extenſion of its ſcale, in the higheſt antiquity.

Meſe, in the Greek muſic, is the fourth ſound of the ſecond tetrachord of the great ſyſtem, and firſt tetrachord invented by the ancients, anſwering to our A, on the fifth line in the baſe. If this ſound then was added to the former three, it proves two important points: firſt, that the moſt ancient tetrachord was that from E in the baſe to A; and that the three original ſtrings in the Mercurian and Apollonian lyre were tuned E, F, G, which the Greeks called *Hypate Meſon*, *Parhypate Meſon*, *Meſon Diatonos*. The addition therefore of *Meſe* to theſe, completed the firſt and moſt ancient tetrachord, E, F, G, A.

The ſtring *lichanos*, then, being added to theſe, and anſwering to our D on the third line in the baſe, extended the compaſs downwards, and gave the ancient lyre a regular ſeries of five ſounds in the Dorian mode, the moſt ancient of all the Greek modes; and the two ſtrings called *Hypate* and *Parhypate*, correſponding with our B and C in the baſe, completed the heptachord, or ſeven ſounds, B, C, D, E, F, G, A, a compaſs that received no addition till after the time of Pindar, who calls the inſtrument then in uſe the *ſeven-tongued lyre*.

Lyre. cept the Laocoon, is the only piece of Greek ſculpture mentioned by Pliny that is now remaining. The two projections near the bottom ſeem to have been faſtenings for the ſtrings, and to have anſwered the purpoſe of tail-pieces in modern inſtruments.

2. The lyre held by Terpſichore, in the picture of that muſe dug out of Herculaneum.

3. The Abyſſinian teſtudo, or lyre in uſe at preſent in the province of Tigre, from a drawing of Mr Bruce, communicated to Dr Burney. "This inſtrument (ſays he) has ſometimes five, ſometimes ſix, but moſt frequently ſeven ſtrings, made of the thongs of raw ſheep or goat ſkins, cut extremely fine, and twiſted; they rot ſoon, are very ſubject to break in dry weather, and have ſcarce any ſound in wet. From the idea, however, of this inſtrument being to accompany and ſuſtain a voice, one would think that it was better mounted formerly.

"The Abyſſinians have a tradition, that the ſiſtrum, lyre, and tambourine, were brought from Egypt into Ethiopia, by Thot, in the very firſt ages of the world. The flute, kettle-drum, and trumpet, they ſay, were brought from Paleſtine, with Menelek, the ſon of their queen of Saba by Solomon, who was their firſt Jewiſh king.

"The lyre in Amharic is called *beg*, 'the ſheep;' in Ethiopic, it is called *meſinko*; the verb *ſinko* ſignifies to ſtrike ſtrings with the fingers: no plectrum is ever uſed in Abyſſinia; ſo that meſinko, being literally interpreted, will ſignify the 'ſtringed inſtrument played upon with the fingers.'

"The ſides which conſtitute the frame of the lyre were anciently compoſed of the horns of an animal of the goat kind called *agazan*, about the ſize of a ſmall cow, and common in the province of Tigre. I have ſeen ſeveral of theſe inſtruments very elegantly made of ſuch horns, which nature ſeems to have ſhaped on purpoſe. Some of the horns of an African ſpecies of this animal may be ſeen in M. Buffon's hiſtory of the king of France's cabinet. They are bent, and leſs regular than the Abyſſinian; but after fire-arms became common in the province of Tigre, and the woods were cut down, this animal being more ſcarce, the lyre has been made of a light red wood; however, it is always cut into a ſpiral twiſted form, in imitation of the ancient materials of which the lyre was compoſed. The drawing I ſend you was one of theſe inſtruments made of wood.

"The kingdom of Tigre, which is the largeſt and moſt populous province of Abyſſinia, and was during many ages the ſeat of the court, was the firſt which received letters and civil and religious government; it extended once to the Red Sea: various reaſons and revolutions have obliged the inhabitants to reſign their ſea-coaſt to different barbarous nations, Pagan and Mahometan: while they were in poſſeſſion of it, they ſay that the Red Sea furniſhed them with tortoiſe-ſhells, of which they made the bellies of their lyres, as the Egyptians did formerly, according to Apollodorus and Lucian; but having now loſt that reſource, they have adopted, in its place, a particular ſpecies of gourd, or pumpkin, very hard and thin in the bark, ſtill imitating with the knife the ſquares, compartments, and figure of the ſhell of the tortoiſe.

"The lyre is generally from three feet to three feet ſix inches high; that is, from a line drawn thro' the point of the horns, to the lower part of the baſe of the ſounding board. It is exceedingly light, and eaſy of carriage, as an inſtrument ſhould naturally be in ſo rugged and mountainous a country. Lyre.

"When we conſider the parts which compoſe this lyre, we cannot deny it the earlieſt antiquity. Man in his firſt ſtate was a hunter and a fiſher, and the oldeſt inſtrument was that which partakes moſt of that ſtate. The lyre, compoſed of two principal pieces, owes the one to the horns of an animal, the other to the ſhell of a fiſh.

"It is probable, that the lyre continued with the Ethiopians in this rude ſtate as long as they confined themſelves to their rainy, ſteep, and rugged mountains: and afterwards, when many of them deſcended along the Nile in Egypt, its portability would recommend it in the extreme heats and wearineſs of their way. Upon their arrival in Egypt, they took up their habitation in caves, in the ſides of mountains, which are inhabited to this day. Even in theſe circumſtances, an inſtrument larger than the lyre muſt have been inconvenient and liable to accidents in thoſe caverns; but when theſe people increaſed in numbers and courage, they ventured down into the plain, and built Thebes. Being now at their eaſe, and in a fine climate, all nature ſmiling around them, muſic and other arts were cultivated and refined, and the imperfect lyre was extended into an inſtrument of double its compaſs and volume. The ſize of the harp could be now no longer an objection; the Nile carried the inhabitants every where eaſily, and without effort; and we may naturally ſuppoſe in the fine evenings of that country, that the Nile was the favourite ſcene upon which this inſtrument was practiſed; at leaſt the ſphinx and lotus upon its head, ſeem to hint that it was ſomeway connected with the overflowings of that river." See HARP.

4. An Etruſcan lyre, with ſeven ſtrings, in the collection of Etruſcan, Greek, and Roman antiquities, publiſhed from the cabinet of the Hon. Sir William Hamilton, Vol. I. Naples 1766. Pl. cix. With reſpect to this inſtrument, it is worthy of obſervation, that though the vaſe upon which it is repreſented is of ſuch indiſputable and remote antiquity, the tail-piece, bridge, belly, and ſound-holes, have a very modern appearance, and manifeſt a knowledge in the conſtruction of muſical inſtruments among the Etruſcans ſuperior to that of the Greeks and Romans in much later times. The lower part of the inſtrument has much the appearance of an old baſs-viol, and it is not difficult to diſcover in it more than the embryo of the whole violin family. The ſtrings lie round, as if intended to be played on with a bow; and even the croſs lines on the tail-piece are ſuch as we frequently ſee on the tail-pieces of old viols.

5. The Tripodian lyre of Pythagoras the Zacynthian, from a bas-relief in the Maffei palace at Rome repreſenting the whole choir of the muſes. Athenæus gives the following account of this extraordinary inſtrument, *lib.* xiv. *cap.* 15. *p.* 637. "Many ancient inſtruments are recorded (ſays Artemon), of which we have ſo little knowledge, that we can hardly be certain of their exiſtence; ſuch as the tripod of Pythagoras the Zacynthian, which, on account of its difficulty, continued in uſe but a ſhort time. It reſembled in form the Delphic tripod, whence it had its name. The legs were equidiſtant, and fixed upon

Bellows for inflating the Lungs, in order to restore suspended respiration.

Fig. 1.

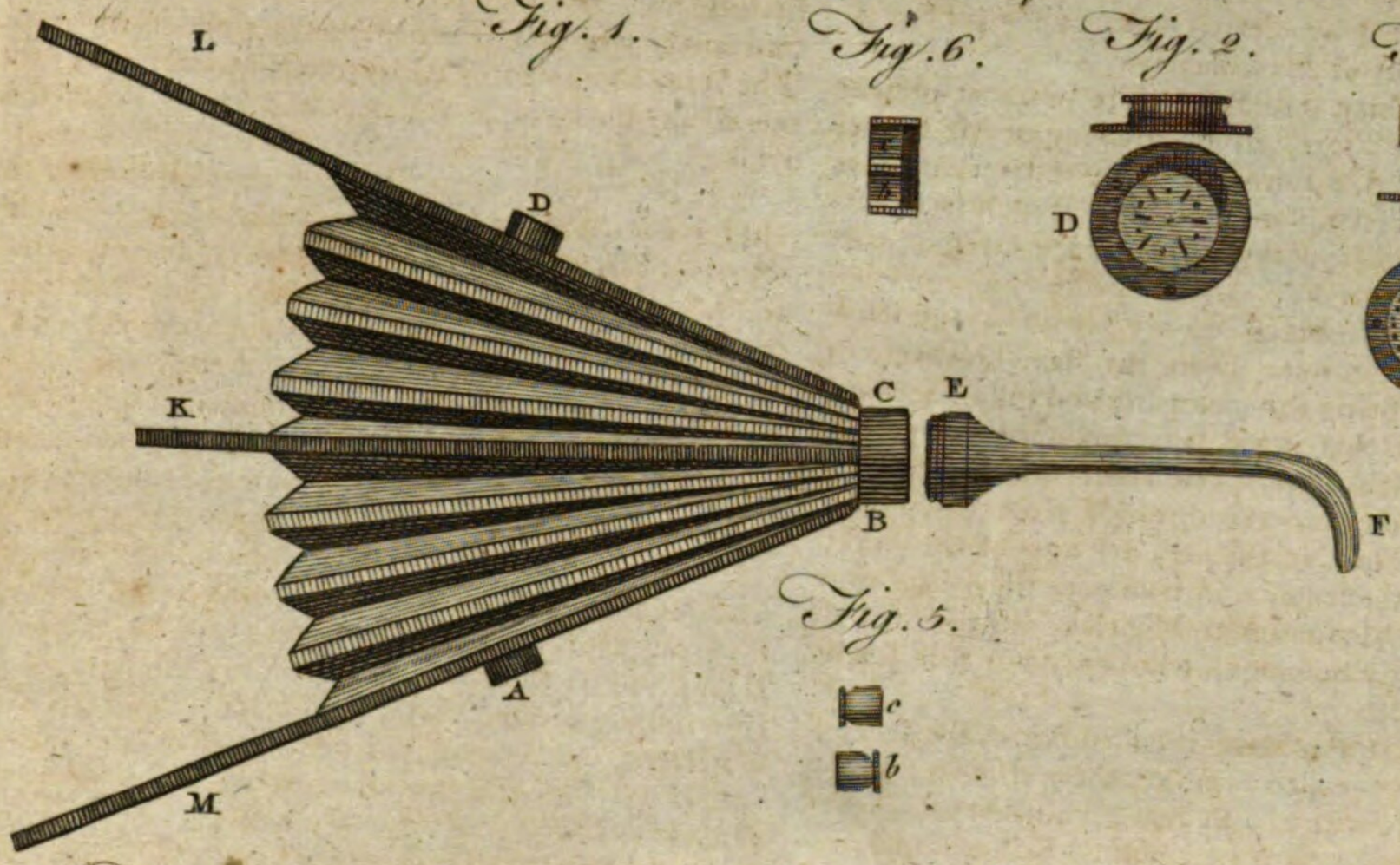


Fig. 6.

Fig. 2.

Fig. 3.

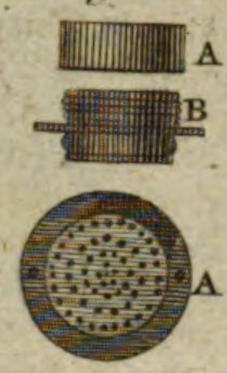


Fig. 4.

Fig. 5.

Ancient Lyres.

Fig. 1.

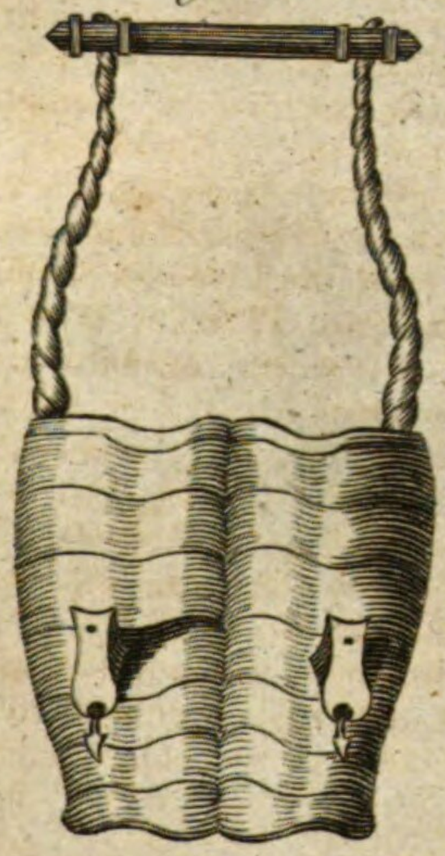
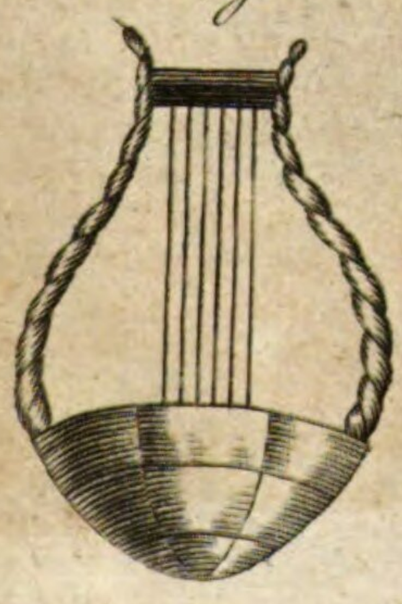


Fig. 2.

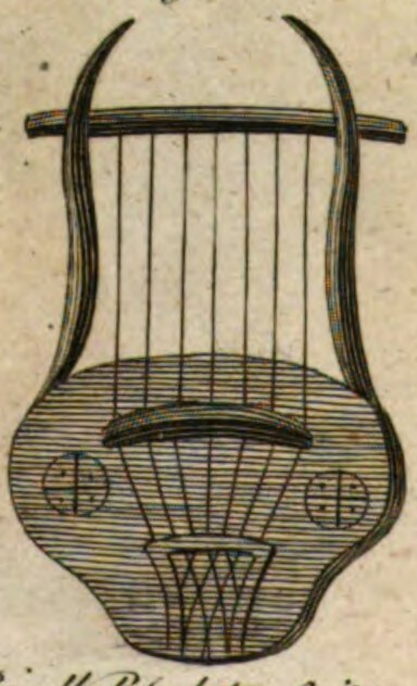
Fig. 6.

Fig. 3.



Lucanus.

Fig. 4.



A. Bell. Prin. Mal. Sculptor. fecit.

Lyric ‖ Lyſias.

upon a moveable baſe that was turned by the foot of the player; the ſtrings were placed between the legs of the ſtool; the vaſe at the top ſerved for the purpoſe of a ſound-board, and the ſtrings of the three ſides of the inſtrument were tuned to three different modes, the Doric, Lydian, and Phrygian. The performer ſat on a chair made on purpoſe; ſtriking the ſtrings with the fingers of the left hand, and uſing the plectrum with the right, at the ſame time turning the inſtrument with his foot to whichever of the three modes he pleaſed: ſo that by great practice he was enabled to change the modes with ſuch velocity, that thoſe who did not ſee him would imagine they heard three different performers playing in three different modes. After the death of this admirable muſician, no other inſtrument of the ſame kind was ever conſtructed."

6. A lyre in the famous ancient picture dug out of Herculaneum, upon which Chiron is teaching the young Achilles to play. See CHIRON.

LYRIC-POETRY, was ſuch as the ancients ſung to the lyre or harp.—It was originally employed in celebrating the praiſes of gods and heroes, and its characteriſtic was ſweetneſs. Who was the author of it is not known. It was much cultivated by the Greeks; and Horace was the firſt who attempted it in the Latin language. Anacreon, Alcæus, Steſichorus, Sappho, and Horace, were the moſt celebrated lyric poets of antiquity.

LYRODI, among the ancients, a kind of muſicians who played on the lyre and ſung at the ſame time. This appellation was alſo given to ſuch as made it their employment to ſing lyric poems compoſed by others.

LYS, or LIS. See LIS.

LYS, the name of a meaſure uſed by the Chineſe in eſtimating diſtances. Two hundred lys make 60 geographical miles, which are equal to one degree.

LYSANDER, a famous Spartan general. See SPARTA.

LYSANDRIA, a Samian feſtival, celebrated with games and ſacrifices in honour of the Lacedemonian general Lyſander. It was anciently called *herea*; but this name the Samians aboliſhed by a public decree.

LYSIARCH, an ancient magiſtrate, who ſuperintended the ſacred games, and preſided in matters of religion in the province of Lycia. He was created in a council conſiſting of deputies from all the provincial cities, in number 23. The lyſiarchs were both heads of the council and pontiffs of the province.

LYSIAS, an ancient Grecian orator, was born at Syracuſe in the 80th olympiad. At 15, he went to Thurion, a colony of the Athenians; and when grown up, aſſiſted in the adminiſtration of the government there many years. When about 47 years of age, he returned to Athens; whence, being afterwards baniſhed by the 30 tyrants, he went to Megara. Upon his return, Thraſybulus would have had him employed again in ſtate matters; but this not taking place, he ſpent the remainder of his life as a private man. He was very familiar with Socrates, and other illuſtrious philoſophers. He profeſſed to teach the art of ſpeaking; not that he pleaded at the bar himſelf, but he ſupplied others with ſpeeches. "Fuit Lyſias in cauſis forenſibus non verſatus" (ſays Cicero), ſed egregie ſubtilis ſcriptor atque elegans," &c. Quintilian calls him, "ſubtilis atque elegans, et quo nihil, ſi Oratorio ſatis ſit docere, quæras perfectius. Nihil enim eſt inane, nihil arceſſitum; puro tamen fonti, quam magno flumini, proprior." Plutarch and Photius relate, that 425 orations were formerly exhibited under the name of Lyſias; of which 34 only are now extant. The beſt edition of them is by Dr John Taylor at London, 1739, 4to; Cambridge, 1740, 8vo.

Lyſimachia ‖ Lythrum.

LYSIMACHIA, LOOSESTRIFE, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 20th order, *Rotaceæ*. The corolla is rotaceous; the capſule globular, beaked, and ten-valved. There are ten ſpecies, but only four are commonly cultivated in gardens. Theſe are hardy, herbaceous perennials and biennials, riſing with erect ſtalks from 18 inches to two or three feet high; garniſhed with narrow entire leaves; and terminated by ſpikes and cluſters of monopetalous, rotated, five-parted ſpreading flowers of white and yellow colours.—They are eaſily propagated by ſeeds, and will thrive in any ſoil or ſituation.

LYSIPPUS, a celebrated Greek ſtatuary, was born at Sicyone, and at firſt followed the buſineſs of a lockſmith, which he quitted in order to practiſe painting: But he afterwards applied himſelf entirely to ſculpture; in which he acquired an immortal reputation, and made a great number of ſtatues that were the admiration of the people of Athens and Rome. His grand ſtatue of the ſun repreſented in a car drawn by four horſes, was worſhipped at Rhodes; he made ſeveral ſtatues of Alexander and his favourites, which were brought to Rome by Metellus after he had reduced the Macedonian empire; and the ſtatue of a man wiping and anointing himſelf after bathing, being particularly excellent, was placed by Agrippa before his baths in that city. He lived in the time of Alexander the Great, about 334 B. C.; and left three ſons, who were all famous ſtatuaries.

LYTHRUM, PURPLE LOOSESTRIFE, in botany. A genus of the monogynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 17th order, *Calycanthemæ*. The calyx is cleft in 12 parts; and there are ſix petals inſerted into it; the capſule is bilocular and polyſpermous. There are 10 ſpecies, of which the moſt remarkable are, 1. The ſalicaria, or common purple looſeſtrife, with oblong leaves, is a native of Britain, and grows naturally by the ſides of ditches and rivers. It hath a perennial root, from which come forth ſeveral upright angular ſtalks, riſing from three to four feet high, garniſhed with oblong leaves placed ſometimes by pairs; but ſometimes there are three leaves at each joint ſtanding round the ſtalk. The flowers are purple, and produced in a long ſpike at the top of the ſtalk; ſo make a fine appearance. 2. The hyſſopanum, or Spaniſh looſeſtrife, with an hyſſop leaf, grows naturally in Spain and Portugal. It hath a perennial root. The ſtalks are ſlender, not more than nine or ten inches long, ſpreading out on every ſide. The lower part of the ſtalks is garniſhed

Lyttelton. with oblong oval leaves placed oppoſite. The flowers come out ſingly from the ſide of the ſtalks at each joint; they are larger than thoſe of the common ſort, and make a fine appearance in the month of July when they are in beauty. The firſt kind is propagated by parting the roots in autumn, but requires a moiſt ſoil;—the ſecond is propagated by ſeeds brought from thoſe countries where it is native.

LYTTELTON (Edward), lord Lyttelton, keeper of the great ſeal in the reign of Charles I. was eminent for his probity and his moderation at the commencement of that monarch's diſputes with his ſubjects. Without forfeiting his fidelity to the king, he preſerved the eſteem of the parliament till 1644, when he was made colonel of a regiment in the king's army at York. He died in 1645. Beſides ſeveral of his ſpeeches which have been printed, he wrote reports in the common pleas and exchequer printed at London in 1683, in folio; ſeveral arguments and diſcourſes, &c.

LYTTELTON (George lord) eldeſt ſon of Sir Thomas Lyttelton, bart. deſcended from the great judge Lyttelton, was born in 1700, at ſeven months; and the midwife ſuppoſing him to be dead, threw him careleſsly into the cradle; where, had not ſome ſigns of life been taken notice of by one of the attendants, he might never have recovered. He received the elements of his education at Eaton-ſchool, where he ſhowed an early inclination to poetry. His paſtorals and ſome other light pieces were originally written in that ſeminary of learning; from whence he was removed to the univerſity of Oxford, where he purſued his claſſical ſtudies with uncommon avidity, and ſketched the plan of his Perſian Letters, a work which afterwards procured him great reputation, not only from the elegance of the language in which they were compoſed, but from the excellent obſervations they contained on the manners of mankind.

In the year 1728, he ſet out on the tour of Europe; and, on his arrival at Paris, accidentally became acquainted with the honourable Mr Poyntz, then our miniſter at the court of Verſailles; who was ſo ſtruck with the extraordinary capacity of our young traveller, that he invited him to his houſe, and employed him in many political negociations, which he executed with great judgment and fidelity.

Mr Lyttelton's conduct, while on his travels, was a leſſon of inſtruction to the reſt of his countrymen. Inſtead of lounging away his hours at the coffee-houſes frequented by the Engliſh, and adopting the faſhionable follies and vices of France and Italy, his time was paſſed alternately in his library and in the ſociety of men of rank and literature. In this early part of his life, he wrote a poetical epiſtle to Dr Ayſcough, and another to Mr Pope, which ſhow ſingular taſte and correctneſs.

After continuing a conſiderable time at Paris with Mr Poyntz, who, to uſe his own words, behaved like a ſecond father to him, he proceeded to Lyons and Geneva; and from thence to Turin, where he was honoured with great marks of friendſhip by his Sardinian majeſty. He then viſited Milan, Venice, Genoa, and Rome, where he applied himſelf cloſely to the ſtudy of the fine arts; and was, even in that celebrated metropolis, allowed a perfect judge of painting, ſculpture, and architecture. Lyttelton.

During his continuance abroad, he conſtantly correſponded with Sir Thomas, his father. Several of his letters are yet remaining, and place his filial affection in a very diſtinguiſhed light. He ſoon after returned to his native country, and was elected repreſentative for the borough of Okehampton in Devonſhire; and behaved ſo much to the ſatisfaction of his conſtituents, that they ſeveral times re-elected him for the ſame place without putting him to the leaſt expence.

About this period, he received great marks of friendſhip from Frederic prince of Wales, father of his preſent majeſty; and was, in the year 1737, appointed principal ſecretary to his royal highneſs, and continued in the ſtricteſt intimacy with him till the time of his death. His attention to public buſineſs did not, however, prevent him from exerciſing his poetical talent. A moſt amiable young lady, Miſs Forteſcue, inſpired him with a paſſion, which produced a number of little pieces, remarkable for their tenderneſs and elegance; and he had a happy facility of ſtriking out an extempore compliment, which obtained him no ſmall ſhare of reputation. One evening being in company with lord Cobham and ſeveral of the nobility at Stowe, his lordſhip mentioned his deſign of putting up a buſt of lady Suffolk in his beautiful gardens; and, turning to Mr Lyttelton, ſaid, "George, you muſt furniſh me with a motto for it." "I will, my lord," anſwered Mr Lyttelton; and directly produced the following couplet:

Her wit and beauty for a court were made,
But truth and goodneſs fit her for a ſhade.

When Mr Pitt, the late earl of Chatham, loſt his commiſſion in the guards, in conſequence of his ſpirited behaviour in parliament, Mr Lyttelton was in waiting at Leiceſter-houſe, and, on hearing the circumſtance, immediately wrote theſe lines:

Long had thy virtue mark'd thee out for fame,
Far, far ſuperior to a cornet's name;
This generous Walpole ſaw, and griev'd to find
So mean a poſt diſgrace that noble mind;
The ſervile ſtandard from thy free-born hand
He took, and bade thee lead the patriot-band.

In the year 1742, he married Lucy, the daughter of Hugh Forteſcue, Eſq; of Filleigh in the county of Devon, the lady abovementioned, whoſe exemplary conduct, and uniform practice of religion and virtue, eſtabliſhed his conjugal happineſs upon the moſt ſolid baſis.

In 1744, he was appointed one of the lords commiſſioners of the treaſury; and, during his continuance in that ſtation, conſtantly exerted his influence in rewarding merit and ability. He was the friend and patron of the late Henry Fielding, James Thomſon author of the Seaſons, Mr Mallet, Dr Young, Mr Hammond, Mr Weſt, Mr Pope, and Voltaire. On the death of Thomſon, who left his affairs in a very embarraſſed condition, Mr Lyttelton took that poet's ſiſter under his protection. He reviſed the tragedy of Coriolanus, which that writer had not put the laſt

Lyttelton. hand to; and brought it out at the theatre-royal, Covent-garden, with a prologue of his own writing, in which he ſo affectingly lamented the loſs of that delightful bard, that not only Mr Quin, who ſpoke the lines, but almoſt the whole audience, ſpontaneouſly burſt into tears.

In the beginning of the year 1746, his felicity was interrupted by the loſs of his wife, who died in the 29th year of her age; leaving him one ſon, Thomas, the late lord Lyttelton; and a daughter, Lucy, who ſome time ſince married lord viſcount Valentia. The remains of his amiable lady were depoſited at Over-Arley in Worceſterſhire; and an elegant monument was erected to her memory in the church of Hagley, which contains the following inſcription written by her huſband:

Made to engage all hearts, and charm all eyes:
Tho' meek, magnanimous; tho' witty, wiſe;
Polite, as all her life in courts had been;
Yet good, as ſhe the world had never ſeen:
The noble fire of an exalted mind,
With gentleſt female tenderneſs combin'd.
Her ſpeech was the melodious voice of love,
Her ſong the warbling of the vernal grove;
Her eloquence was ſweeter than her ſong,
Soft as her heart, and as her reaſon ſtrong.
Her form each beauty of her mind expreſs'd,
Her mind was virtue by the graces dreſs'd.

Beſides theſe beautiful lines, Mr Lyttelton wrote a monody on the death of his lady, which will be remembered while conjugal affection and a taſte for poetry exiſt in this country.

His maſterly obſervations on the converſion and apoſtleſhip of St Paul, were written at the deſire of Gilbert Weſt, Eſq; in conſequence of Mr Lyttelton's aſſerting, that, beſide all the proofs of the Chriſtian religion, which might be drawn from the prophecies of the Old Teſtament, from the neceſſary connection it has with the whole ſyſtem of the Jewiſh religion, from the miracles of Chriſt, and from the evidence given of his reſurrection by all the other apoſtles, he thought the converſion of St Paul alone, duly conſidered, was of itſelf a demonſtration ſufficient to prove Chriſtianity to be a divine revelation. Mr Weſt was ſtruck with the thought; and aſſured his friend, that ſo compendious a proof would be of great uſe to convince thoſe unbelievers that will not attend to a longer ſeries of arguments; and time has ſhown he was not out in his conjecture, as the tract is eſteemed one of the beſt defences of Chriſtianity which has hitherto been publiſhed. Lyttelton.

In 1754, he reſigned his office of lord of the treaſury, and was made cofferer to his majeſty's houſehold, and ſworn of the privy-council: previous to which, he married, a ſecond time, Elizabeth, daughter of field-marſhal Sir Robert Rich, whoſe indiſcreet conduct gave him great uneaſineſs, and from whom he was ſeparated by mutual conſent, a few years after his marriage.

After being appointed chancellor and under-treaſurer of the court of exchequer, he was, by letters-patent dated the 19th of November 1757, 31 Geo. II. created a peer of Great Britain, by the ſtyle and title of *Lord Lyttelton, baron of Frankley, in the county of Worceſter.* His ſpeeches on the Scotch and mutiny bills in the year 1747, on the Jew bill in 1753, and on the privilege of parliament in 1763, ſhowed ſound judgment, powerful eloquence, and inflexible integrity. During the laſt ten years he lived chiefly in retirement, in the continual exerciſe of all the virtues which can ennoble private life. His laſt work was Dialogues of the Dead, in which the morality of Cambray and the ſpirit of Fontenelle are happily united.

He was ſuddenly ſeized with an inflammation of the bowels, in the middle of July 1773, at his ſeat at Hagley; which terminated in his death, on the 22d of that month. His laſt moments were attended with unimpaired underſtanding, unaffected greatneſs of mind, calm reſignation, and humble but confident hopes in the mercy of God. As he had lived univerſally eſteemed, he died lamented by all parties. A complete collection of his works has been publiſhed ſince his deceaſe, by his nephew George Aſycough, Eſq.

M.

M, a liquid conſonant, and the twelfth letter in the alphabet.

It has one unvaried ſound, and is pronouuced by ſtriking the upper lip againſt the lower; in which the pronunciation of this letter agrees with that of *b*; the only difference between the two conſiſting in a little motion made in the noſe in pronouncing *m*, and not in *b*: whence it happens that thoſe who have taken cold, for *m* ordinarily pronounce *b*; the noſe in that caſe being diſabled from making the neceſſary motion.

All conſonants are formed with the aid of vowels; in *em* the vowel precedes, in *be* it follows; and *m* is never mute.

Quintilian obſerves, that the *m* ſometimes ends Latin words, but never Greek ones; the Greeks always changing it in that caſe into *n*, for the ſake of the better ſound.

M is alſo a numeral letter, and among the ancients was uſed for a thouſand; according to the verſe,

M *caput eſt numeri, quem ſcimus mille teneri.*

When a daſh is added to the top of it, as $\overline{M}$; it ſignifies a thouſand times a thouſand.

Maat || Macao.

M, as an abbreviature, ſtands for Manlius, Marcus, Martius, and Mucius: M. A. ſignifies *magiſter artium*, or maſter of arts; MS. manuſcript, and MSS. manuſcripts.

M, in aſtronomical tables, and other things of that kind, is uſed for *meridional* or ſouthern; and ſometimes for *meridian* or mid-day.

M, in medicinal preſcription, is frequently uſed to ſignify a maniple or handful: and it is ſometimes alſo put at the end of a recipe, for *miſce* "mingle;" or for *mixtura* "a mixture." Thus, *m. f. julapium*, ſignifies "mix and make a julep."

M, in law, the brand or ſtigma of a perſon convicted of manſlaughter, and admitted to the benefit of his clergy. It is to be burnt on the brawn of his left thumb.

MAAT (John). See BLANKOF.

MABA, in botany: A genus of the triandria order, belonging to the dioecia claſs of plants. The perianthium of the male is trifid; that of the female is as in the male; the fruit is a plum two-celled ſuperior.

MABILLON (John), a very learned writer of France in the 17th century, was born at Perre-monte, on the frontiers of Champagne, in 1632. He was educated in the univerſity of Rheims, and afterwards entered into the abbey of the Benedictines of St Remy. In the year 1663, he was appointed keeper of the treaſures and monuments of France at St Dennis: but having unfortunately broke a looking-glaſs there, which was pretended to have belonged to Virgil, he deſired leave of his ſuperiors to quit an employment which frequently obliged him to tell things he did not believe. Next year he went to Paris; and was very ſerviceable to Father d'Acheri, who was deſirous of having ſome young monk who could aſſiſt him in compiling his *Spicilegium*. This made him known. Soon after, the congregation of St Maur having formed a deſign of publiſhing new editions of the fathers, reviſed from the MSS. in the libraries of the Benedictines, Mabillon was charged with the edition of St Bernard, which he prepared with extraordinary diligence. After that, he publiſhed many other works, which are evidences of his vaſt capacity and induſtry. In 1682, he was employed by Mr Colbert in examining ſome ancient titles relating to the royal family. The year following he ſent him into Germany, to ſearch the archives and libraries of the ancient abbeys, for what was moſt curious and proper to illuſtrate the hiſtory of the church in general, and that of France in particular. He has publiſhed an account of this journey. In 1685, he undertook another journey into Italy, by order of the king of France; and returned the year following with a very noble collection. He placed in the king's library above 3000 volumes of rare books, printed and in MSS. and compoſed two volumes of the pieces which he had diſcovered in that country. He was highly eſteemed for his virtues as well as his learning.

MACACO, or MACAUCO. See LEMUR.

MACAO, a town of China, in the province of Canton, ſeated in an iſland at the mouth of the river Tae. The Portugueſe have been in poſſeſſion of the harbour for 150 years. Formerly they had a great trade here; but now they have only a fort with a ſmall garriſon. The houſes are built after the European manner; and there is a Chineſe mandarin, as well as a Portugueſe governor, to take care of the town and the neighbouring country. E. Long. 112. 13. N. Lat. 22. 12.

Macao || Macaronic.

MACAO, in ornithology. See PSITTACUS.

MACARIANS, in eccleſiaſtical hiſtory, the followers of Macarius, an Egyptian monk, who was diſtinguiſhed towards the cloſe of the fourth century for his ſanctity and virtue. In his writings there are ſome ſuperſtitious tenets, and alſo certain opinions that ſeem tainted with Origeniſm. The name has been alſo applied to thoſe who adopted the ſentiments of Macarius a native of Ireland, who, about the cloſe of the ninth century, propagated in France the error afterwards maintained by Averrhoes, that one individual intelligence or ſoul performed the ſpiritual and rational functions in all the human race.

MACARONI. See FOLENGIO, and the next article.

MACARONIC, or MACARONIAN, a kind of burleſque poetry, conſiſting of a jumble of words of different languages, with words of the vulgar tongue Latonized, and Latin words modernized. *Maccaroni* among the Italians, as has been obſerved by Cælius Rhodiginus, ſignifies *a coarſe clowniſh man*; and becauſe this kind of poetry is patched out of ſeveral languages, and full of extravagant words, &c. the Italians, among whom it had its riſe, gave it the name of *maccaronian*, or *maccaronic* poetry. Others chooſe to derive it *à macaronibus*, from *macaroons*, a kind of confection made of meal not boulted, ſweet-almonds, ſugar, and the white of eggs, accounted a great dainty among the country-people in Italy; which, from their being compoſed of various ingredients, occaſioned this kind of poetry, which conſiſts of Latin, Italian, Spaniſh, French, Engliſh, &c. to be called by their name.

Example.—A bold fellow in the *macaronic* ſtyle, ſays,

Enfilavi omnes ſcadrones & regimandos, &c.

Another example:

Archelos piſtoliferos furiamque manantum,
Et grandem eſmeutam quæ inopinum facta ruelle eſt:
Toxinumque alto troublantem corda clochero, &c.

Theoph. Folengius, a Benedictine monk of Mantua, was the firſt who invented, or at leaſt cultivated, this kind of verſe. See FOLENGIO.

The beſt pieces of this kind are, the *Baldus* of Folengio, and *Macaronis Forza* by Steſonio a Jeſuit, among the Italians; and the *Reatus veritabilis ſuper terribili eſmeuta paiſanarum de Ruellis*, among the French. The famous Rabelais firſt transferred the *macaronic* ſtyle out of the Italian verſe into French proſe: and on the model thereof formed ſome of the beſt things in his *Pantagruel*. We have little in Engliſh in the *macaronian* way; nothing ſcarce, but ſome little looſe pieces collected in Camden's remains. But the Germans and Netherlanders have had their *macaronic* poets; witneſs the *Certamen Catholicum cum Calviniſtis*, of one Martinius Hamconius Friſius, which contains about 1200 verſes, all the words whereof begin with the letter *C*.

MACARSKA,

Macarſka || Maccabee

MACARSKA, a town of Dalmatia, and capital of Primogria, with a pretty good harbour, and a biſhop's ſee, ſeated on the gulph of Venice. E. Lon. 17. 57. N. Lat 43. 42.

MACASSAR, a conſiderable kingdom of the iſland of Celebes, in the Eaſt-Indies. The climate is very hot; and would be intolerable, were it not for the rains which fall when the ſun is directly over their heads. The ſoil is extremely fertile, and there are ripe fruits at all times of the year. There are great numbers of monkies, who are devoured by monſtrous ſerpents; ſome of which are ſo large, that they will ſwallow one of theſe animals entire. The Macaſſars are large, robuſt, courageous, and greatly addicted to war. They profeſs the Mahometan religion.

Macassar, a large, ſtrong, and handſome town of the iſland of Celebes, and capital of the kingdom of the iſland of Celebes, where the king reſides. The houſes are all built of wood, and ſupported by thick poſts; and they have ladders to go up into them, which they draw up as ſoon as they have entered. The roofs are covered with very large leaves, which prevent the rain from entering. It is ſeated near the mouth of a large river, which runs through the kingdom from north to ſouth. E. Long. 117. 55. S. Lat. 5. 0.

Macassar Poiſon, in natural hiſtory, called *ippo* in the Macaſſar and Malayan tongue, is the gum of a certain tree, ſhining, brittle, black, and every way like ſtone-pitch, growing in the iſland Celebes, in the South Seas; with which all the natives arm themſelves in travel, having a long hollow trunk of a hard red wood like braſil, accurately bored, and at one end is fixed a large lance-blade of iron. Then they make a ſmall arrow, very ſtraight, and ſomewhat bigger than a large wheaten ſtraw: at one end they fix it into a round piece of white, light, ſoft, wood, like cork, about the length of the little finger, juſt fit for the bore of the trunk, to paſs clear by the force of one's breath, and to fill it ſo exactly, that the air may not paſs by, but againſt it, in order to carry it with the greater force. At the other end they fix in it either a ſmall fiſh-tooth for that purpoſe, or make a blade of wood of the bigneſs of the point of a lancet, about three-quarters of an inch long, and making a little notch in the end of the arrow, they ſtrike it firm therein, which they anoint with poiſon. The poiſonous gum, when gathered, is put into hollow bamboos or canes, ſtopped up very cloſe, and thus brought to Macaſſar. When they fit it for uſe, they take a piece of ſmooth turtle-ſhell, and a ſtick cut flat and ſmooth at the end: then they take green galangal root, grate it, and with the addition of a little fair water, preſs the juice into a clean china diſh: then with a knife ſcraping a little of the poiſon upon the ſhell, dip the end of the ſtick in the forementioned liquor, and with this diſſolve the poiſon to the conſiſtence of a ſyrup: when this is done, they anoint the fiſh-tooth or wooden blade with the ſame ſtick, and lay it in the ſun, ſo that it may be baked hard. The pointed arrows thus prepared, are put in hollow bamboos, cloſe ſhut, and in this ſtate they retain their virtue for a month.

MACCABÆUS (Judas). See Judas.

MACCABEES, two apocryphal books of ſcripture, containing the hiſtory of Judas and his brothers, and their wars againſt the Syrian kings in defence of their religion and liberties, ſo called from Judas Mattathias, ſurnamed *Maccabeus*, as ſome ſay from the word מכבי, formed of the initials of מי כמכה באלם יהוה, q. d. *Who is like unto thee, O Lord, among the Gods*; which was the motto of his ſtandard; whence thoſe who fought under his ſtandard were called *Maccabees*, and the name was generally applied to all who ſuffered in the cauſe of the true religion, under the Egyptian or Syrian kings. The firſt book of the Maccabees is an excellent hiſtory, and comes neareſt to the ſtyle and manner of the ſacred hiſtorians of any extant. It was written originally in the Chaldee language, of the Jeruſalem dialect, and was extant in this language in the time of Jerom. From the Chaldee it was tranſlated into Greek, from the Greek into Latin. It is ſuppoſed to have been written by John Hyrcanus the ſon of Simon, who was prince and high prieſt of the Jews near 30 years, and began his government at the time where this hiſtory ends. It contains the hiſtory of 40 years, from the reign of Antiochus Epiphanes to the death of Simon the high prieſt; that is, from the year of the world 3829 to the year 3869; 131 years before Chriſt. The ſecond book of the Maccabees begins with two epiſtles ſent from the Jews of Jeruſalem to the Jews of Egypt and Alexandria; to exhort them to obſerve the feaſt of the dedication of the new altar erected by Judas on his purifying the temple. The firſt was written in the 169th year of the era of the Seleucidæ, *i. e.* before Chriſt 144; and the ſecond in the 188th year of the ſame era, or 125 before Chriſt; and both appear to be ſpurious. After theſe epiſtles follows the preface of the author to his hiſtory, which is an abridgement of a larger work, compoſed by one Jaſon, a Jew of Cyrene, who wrote in Greek the hiſtory of Judas Maccabeus and his brethren, and the wars againſt Antiochus Epiphanes, and Eupator his ſon. This ſecond book does not by any means equal the accuracy and excellency of the firſt. It contains a hiſtory of about 15 years, from the execution of Heliodorus's commiſſion, who was ſent by Seleucus to fetch away the treaſures of the temple, to the victory obtained by Judas Maccabeus over Nicanor; that is, from the year of the world 3828, to the year 3843, 147 years before Chriſt.

Maccabees.

There are in the Polyglot bibles, both of Paris and London, Syriac verſions of both theſe books; but they, as well as the Engliſh verſions which we have among the apocryphal writers in our Bibles, are derived from the Greek. There is alſo a third book of the Maccabees, containing the hiſtory of the perſecution of Ptolemy Philopator againſt the Jews in Egypt, and their ſufferings under it; and ſeems to have been written by ſome Alexandrian Jew in the Greek language, not long after the time of Siracides. It is in moſt of the ancient manuſcript copies of the Greek Septuagint, particularly in the Alexandrian and Vatican, but was never inſerted into the vulgar Latin verſion of the Bible, nor conſequently into any of our Engliſh copies. Moreover, Joſephus's hiſtory of the martyrs that ſuffered under Antiochus Epiphanes, is found in ſome manuſcript Greek Bibles, under the name of the fourth book of the *Maccabees*.

Macbeth, Macbride.

MACBETH, a Scots nobleman in the 11th century, nearly allied to Duncan king of Scotland.—Not contented with curbing the king's authority, he carried his peſtilent ambition ſo far as to put him to death; and, chaſing Malcolm Kenmure his ſon and heir into England, uſurped the crown. Siward earl of Northumberland, whoſe daughter Duncan had married, undertook, by the order of Edward the Confeſſor, the protection of the fugitive prince.—He marched with an army into Scotland; defeated and killed Macbeth; and reſtored Malcolm to the throne of his anceſtors. Shakeſpeare has made this tranſaction the ſubject of one of his beſt tragedies.

MACBRIDE (Dr David), an eminent phyſician and philoſopher, was deſcended from an ancient family in the county of Galloway in Scotland. His grandfather, a clergyman, had ſettled in Ireland about the end of the laſt century, as miniſter to a Preſbyterian congregation at Belfaſt; and his father, who followed the ſame line, was ſettled at Ballymony in the county of Antrim, where he married, and where our author was born in April 1726. After a proper ſchool-education, and having paſſed ſome time under the tuition of an eminent ſurgeon in his native place, he was ſent to the univerſity of Glaſgow. Having there completed the uſual courſe of academical ſtudies, he came to Edinburgh for the further proſecution of medical ſcience. After a ſhort ſtay here, a war then prevailing between France and Britain, he was induced to go on board the navy in the ſtation of a ſurgeon's mate. In the ſervice of his country he continued for ſeveral years; and after diſcharging for ſome time the duties of an aſſiſtant, he was raiſed to the rank of ſurgeon. In this ſituation, he firſt turned his thoughts towards the diſcovery of a remedy for the ſea-ſcurvy. It was not, however, at this period, that either chance or reaſoning ſuggeſted to him the employment of an article which has ſince been attended with the moſt beneficial conſequences. Here he had an opportunity only of obſerving the ſymptoms, of ſtudying the nature, and of lamenting the conſequences, of the diſeaſe.

The termination of the war by the peace of Aix-la-Chapelle put a period to Dr Macbride's employment as a naval ſurgeon. He had now probably obtained much medical knowledge in the ſchool of experience; but he was ſenſible that he had ſtill much to acquire in that of ſcience. An ardent keenneſs to mingle in active life had led him from the ſchools of medicine at an earlier period than could have been wiſhed; and an earneſt deſire to found his future practice in the beſt eſtabliſhed principles led him back to them, when a judgment, matured by years, and informed from the obſervation of facts, rendered him capable of hearing teachers with greater advantage. He returned therefore to Edinburgh, and again entered on the career of academical purſuits, under the tuition of Dr Monro, and thoſe other teachers, whoſe abilities raiſed the fame of the medical ſchool at this place. But not ſatisfied with the inſtructions to be had from any one ſet of profeſſors, the celebrity of the medical teachers in London led him alſo to viſit that capital. There he particularly became the pupil of thoſe diſtinguiſhed lecturers, Dr Hunter and Dr Smellie. And while from the former he laboured to acquire an accurate chirurgical knowledge, from the latter he endeavoured to obtain the true principles of widwifery conſidered as a ſcience. At the ſame time, he was no leſs induſtrious in improving himſelf in the ſucceſsful practice of both arts by attention at hoſpitals. Macbride.

Thus prepared for the exerciſe of his profeſſion, about the end of the year 1749 he fixed his reſidence in Dublin in the character of ſurgeon and accoucheur. If amiable manners, and extenſive knowledge of his profeſſion, could alone have been ſufficient introductions to practice, he might in a ſhort time have looked for a competent ſhare of buſineſs in that capital; but while he had to combat that objection which very generally ariſes from youth, his progreſs was alſo not a little retarded by an uncommon degree of modeſty. Hence for ſeveral years he remained almoſt in a ſtate of obſcurity, and was employed by but few people either of rank or fortune. But, if it is to be regretted that for many years his time was not ſo fully employed in the lucrative part of his profeſſion as was due to his merit, it ought ſtill to be remembered, that this eſſentially promoted the cauſe of ſcience: for by this means his genius and induſtry were directed to medical reſearches; and were productive of diſcoveries which will with honour tranſmit his name to lateſt poſterity. Theſe, though ſome of them might have been ſucceſsfully turned to his own emolument, were freely communicated to the world in different publications; and he did not ſhow greater ingenuity in making diſcoveries, than liberality of ſentiment in publiſhing them for the advantage of others.—His firſt publication, intitled, "Experimental Eſſays on Medical and Philoſophical Subjects," made its appearance in the year 1764.—Theſe eſſays are five in number: 1. On the fermentation of alimentary mixture and the digeſtion of the food. 2. On the nature and properties of fixed air. 3. On the different kinds of antiſeptics. 4. Of the diſſolvent power of quicklime. 5. Of the ſea-ſcurvy. The merit of all theſe is ſufficiently known and acknowledged: but the laſt of them is unqueſtionably the moſt important; the method therein propoſed of both the prevention and cure of that dreadful diſeaſe the ſcurvy, having been confirmed by repeated and undeniable obſervation.

Having thus equally diſtinguiſhed himſelf as an ingenious philoſopher and able practitioner, the world were not now ſlow in beſtowing upon him the tribute of applauſe to which he was intitled. His name was enrolled with honour in the liſts of many learned ſocieties; and the univerſity where his ſtudies had firſt been commenced, were proud to confer upon him the degree of Doctor of Medicine.

The reputation, however, of being a diſtinguiſhed author, was to him but a ſecondary object; and his talents were not confined to the advancement of medicine alone. Having ſucceſsfully diſcovered a conſiderable improvement in the art of tanning, with that ſpirited generoſity which is ever the concomitant of real worth, he ſpeedily and freely communicated it to the public, by publiſhing, firſt, "An Account of a New Method of Tanning;" and afterwards, "Inſtructions for carrying on the New Method of Tanning." As a mark of approbation for this liberal conduct, as well as a teſtimony of reſpect for his ingenuity, prize-medals were conferred upon him by the Societies of Arts both in London and Dublin. But his laſt and

moſt

Macbride

most extenſive publication was more immediately in the line of his own profeſſion: It is intitled, "A Methodical Introduction to the Theory and Practice of Medicine." In that valuable work he has given a conciſe and connected view of the principles and practice of the healing art, as beſt eſtabliſhed by ſound reaſon, and confirmed by accurate obſervation. Moſt, if not all of theſe publications, not only went through various editions, but were tranſlated into different languages.

After the merit of Dr Macbride came to be properly known, the public ſeemed to ſhow a deſire of making compenſation for having ſo long overlooked it. His employment increaſed ſo rapidly, that he had more buſineſs than he could tranſact either with eaſe or ſafety. This having kept him in perpetual agitation both of body and mind, at laſt induced an almoſt total incapacity of ſleeping. From this circumſtance his health could not fail to be impaired. In this ſituation, after accidental expoſure to cold, he was attacked with a fever, which put an end to his life on the 13th of December 1778, in the 53d year of his age.

Thoſe who were his moſt intimate acquaintance were inclined to believe that his death was not a little haſtened by domeſtic calamities. During his reſidence in Dublin he was twice married, and was as often ſubjected to that inexpreſſible diſtreſs which muſt reſult from a final ſeparation in this world from the moſt intimate and loving friends. By both of his wives he had ſeveral children; but none of them ſurvived their father. And on theſe calamitous events, although he was able to conceal his feelings from the world, yet they gave a ſevere ſhock to his conſtitution. After his death, ſeveral of the playful trinkets of his infants, with the ſignature of *dulces exuviæ*, were found in his repoſitories among papers on medical and other important ſubjects: an incontrovertible proof, that in him at leaſt, the great mind of the philoſopher was conjoined with the feeling heart of the affectionate father. But if his abilities were remarkable as a philoſopher and phyſician, if his conduct was exemplary as an huſband and parent, his manners were no leſs amiable as a companion and friend. His polite and benevolent conduct, joined to his taſte for the fine arts, conciliated the affections and eſteem of all who knew him. His death was univerſally and ſincerely lamented in the city of Dublin.

MACCLESFIELD, a town of Cheſhire in England, 171 miles from London, is ſeated on the edge of a foreſt of the ſame name, upon a high bank near the river Bollin; and is a large handſome town, with a fine church and a very high ſteeple. It was erected into a borough by King Edward III. is governed by a mayor, and enjoys great privileges and juriſdictions by virtue of the court and the liberties of the foreſt. In its church are two braſs plates, on one of which there is a promiſe of 26,000 years and 26 days pardon for ſaying five Pater-Noſters and five Aves. Its chief manufacture is mohair buttons. The market is on Mondays; the fairs are June 11 and 30, and Nov. 2. In Macclesfield foreſt are many pits dug for the ſake of the turf; in which it is common to ſee fir-trees buried, which are dug up for various uſes, but chiefly for ſplinters that ſerve the poor for candles. W. Long. 2. 10. N. Lat. 53. 15.

Mace, Macedon.

MACE, an ancient weapon, formerly much uſed by the cavalry of all nations. It was commonly made of iron; its figure much reſembles a chocolate-mill; many ſpecimens may be ſeen in the Tower. It was with one of theſe that Walworth mayor of London knocked the rebel Wat Tyler from off his horſe in Smithfield for approaching the young king Richard II. in an inſolent manner; and as he fell, he diſpatched him with his dagger. The mace in modern times changed its form; and being no longer a war inſtrument, is made of copper or ſilver gilt, ornamented with a crown, globe, and croſs, and is now the chief inſignia of authority throughout Great Britain. Similar to the ancient maces, were thoſe ſtaves at the end of which iron or leaden balls armed with ſpikes were ſuſpended by chains: they were till lately carried by the pioneers of the trained-bands or city militia.

Mace, in the materia medica, the ſecond coat or covering of the kernel of the nutmeg, is a thin and membranaceous ſubſtance, of an oleaginous nature, and a yellowiſh colour; being met with in flakes of an inch or more in length, which are divided into a multitude of ramifications. It is of an extremely fragrant, aromatic, and agreeable flavour; and of a pleaſant, but acrid oleaginous taſte.

Mace is carminative, ſtomachic, and aſtringent; and poſſeſſes all the virtues of nutmeg, but has leſs aſtringency.—The oils of mace and nutmeg, whether prepared by diſtillation or expreſſion, are ſo much of the ſame nature, that they may be indiſcriminately uſed for one another on all occaſions. They give eaſe in cholics, and often in nephritic caſes, taken internally from one drop to five or ſix of the diſtilled oil, or an equal quantity of the expreſſed; and externally, they are of uſe to rub paralytic limbs: they alſo aſſiſt digeſtion; and will often ſtop vomitings and hiccoughs, only by being rubbed on the region of the ſtomach. The nurſes have a cuſtom of applying oil of mace by expreſſion to childrens navels to eaſe their gripes, and that often with ſucceſs; and we are aſſured, by authors of credit, that when rubbed on the temples, it promotes ſleep.

MACEDON, or Macedonia, a moſt celebrated kingdom of antiquity, was bounded on the eaſt by the Ægean ſea; on the ſouth by Theſſaly and Epirus; on the weſt by the Ionian ſea or Adriatic; on the north, at firſt by the river Strymon and the Scardian mountains, but afterwards by the river Neſſus or Neſtus. In a direct line the whole country extended only 150 miles in length; but the windings of the coaſt lengthened it out to three times that extent; in which almoſt every convenient ſituation was occupied by a Grecian ſea-port. The country was naturally divided by the Thermaic and Strymonic gulphs, into the provinces of Pieria, Chalcis, and Pangæus. The middle region, which took its name from a city of Euboea from whence it was originally peopled, was very fertile and pleaſant; the inland country, being diverſified by lakes, rivers, and arms of the ſea, was extremely convenient for inland navigation, while the towns of Amphipolis, Potidæa, Acanthus, and many others, afforded marts for the commerce of the republics of Greece, as well as of Thrace and Macedon. On one ſide of this diſtrict were the mountains of Pangæus, and on the other the plains of Pieria. The Pangæan moun-

I Situation, &c. of the country.

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mountains, which extended 90 miles towards the eaſt and the river Neſſus, though proper neither for corn nor paſture, produced plenty of timber for ſhip-building; while the ſouthern branches of the mountain contained rich veins of gold and ſilver; but theſe, though wrought ſucceſſively by the Thaſians and the Athenians, were only brought to perfection by Philip of Macedon, who extracted from them gold and ſilver to the value of 200,000l. Sterling annually. Pieria extended 50 miles along the Thermaic gulph, to the confines of Theſſaly and mount Pindus. The inland part of the country was beautifully diverſified with ſhady hills and fountains; and ſo admirably calculated for ſolitary walks and retirement, that the ancients looked upon it to be the favourite haunt of the muſes, and accordingly beſtowed upon them the title of *Pierides*.

2 Different names.

In the moſt early times this country was called *Æmathia*, from *Æmathius* one of its princes. The name of *Macedon* is ſaid to have been derived from *Macedo* a deſcendant of Deucalion; though others ſuppoſe it to have been only a corruption of *Mygdonia* a diſtrict of the country. In thoſe remote ages of antiquity, Macedon, like moſt other countries of Europe, was divided into a great number of petty principalities, of which ſcarce even the names are known at this time.

3 Kingdom founded by Caranus.

All authors agree, however, that *Caranus* was the firſt who eſtabliſhed any permanent ſovereignty in Macedon. He was an Argive, a deſcendant of Hercules, and about 800 years B. C. conducted a ſmall colony of his countrymen into the inland diſtrict of Macedon at that time diſtinguiſhed by the name of *Æmathia* as already mentioned. This territory was about 300 miles in circumference. On the ſouth it was ſeparated from the ſea by a number of Greek republics, of which the moſt conſiderable were thoſe of Olynthus and Amphipolis; and on the north, eaſt, and weſt, was ſurrounded by the barbarous kingdoms of Thrace, Pœonia, and Illyricum. According to the traditions of thoſe times, Caranus, having conſulted the oracle on the ſucceſs of his intended expedition, was commanded to be directed by the goats in the eſtabliſhment of his empire. For ſome time he proceeded at random, without knowing what to make of the oracle's anſwer; but happening to enter the ſmall kingdom of *Æmathia*, at that time governed by King Midas, he obſerved a herd of goats running towards *Edeſſa* the capital. Recollecting then the anſwer of the oracle, he attacked and took the city by ſurpriſe, ſoon after making himſelf maſter of the whole kingdom. In memory of this remarkable event he called the city *Ægea*, and the people *Ægiates*, from the goats who conducted him, and made uſe of the figure of a goat in his ſtandard. From this fable alſo we ſee why the figure of a goat is ſo frequently ſeen on the coins of Philip and his ſucceſſors.

4 Policy of this prince.

The little colony of Argives led into Æmathia by Caranus would ſoon have been overwhelmed by the barbarous nations who ſurrounded it, had not this prince and his ſubjects taken care to ingratiate themſelves with their neighbours, rather than to attempt to ſubdue them by force of arms. They inſtructed them in the Grecian religion and government, and in the knowledge of many uſeful arts; adopting themſelves, in ſome degree, the language and manners of the barbarians; imparting to them in return ſome part of the Grecian civiliza- Macedon.
tion and polite behaviour. Thus they gradually aſſociated with the fierce and warlike tribes in their neighbourhood; and this prudent conduct, being followed by ſucceeding generations, may be looked upon as one of the cauſes of the Macedonian greatneſs.

Caranus, dying after a reign of three years, left the kingdom to his ſon Cœnus; who having conſiderably enlarged his dominions, was ſucceeded by Thurymas, and he by Perdiccas I. This laſt prince is by Thucydides and Herodotus accounted the founder of the Macedonian monarchy; though his hiſtory is ſo obſcured by fable, that nothing certain can now be known concerning it. In proceſs of time, however, the good underſtanding which had ſubſiſted between the Macedonians and their barbarous neighbours began to ſuffer an interruption; and in 691 B. C. the kingdom was for the firſt time invaded by the Illyrians. At firſt they did conſiderable damage by their ravages; but the Macedonian monarch, Argæus, having decoyed them into an ambuſh, cut off great numbers, and obliged the remainder to leave the kingdom. In the reign of his ſucceſſors, however, they returned, and occaſionally proved very troubleſome enemies till the reigns of Philip and Alexander.

5 Perdiccas I. a celebrated monarch.

6 Invaſion by the Illyrians.

7 Interference of the Perſians and Macedonians.

In the mean time the kingdom of Macedon began to be affected by thoſe great events which took place in other parts of the world. Cyrus having overthrown the Babylonian empire, and conquered all the weſtern part of Aſia, eſtabliſhed a mighty monarchy, which threatened all the eaſtern parts of Europe with ſubjection. The Greeks, however, having now emerged from their barbariſm, and acquired great knowledge in the art of war, were able to reſiſt effectually this very formidable power; but the kingdom of Macedon, obſcure and unconnected, was obliged to yield, and though not formally made a province of the Perſian empire, was nevertheleſs accounted in ſome ſort as under the vaſſalage and protection of the Perſians. Alcetas, who aſcended the Macedonian throne about the time that the Perſian monarchy was founded, had the dexterity to preſerve his dominions from the encroachments of the Greeks on the one hand, and of the Perſians on the other; but in the reign of his ſucceſſor Amyntas a formal demand was made of ſubmiſſion to the great King Darius, by ſending him a preſent of earth and water. Seven ambaſſadors were ſent on this errand by Megabizus, one of the officers of Darius. They were ſumptuouſly entertained by Amyntas; but having attempted to take ſome indecent liberties with the Macedonian women, Alexander the king's ſon cauſed them all to be murdered. This raſh action had almoſt proved the ruin of the kingdom; but Alexander found means to pacify Bubaris the general ſent againſt him by Megabizus, by ſhowing him his ſiſter Gygæa, a very beautiful woman, with whom the Perſian fell in love at firſt ſight, and afterwards married her.

8 Advantages accruing to Macedon from this interference.

From this time the Macedonians were accounted the faithful allies of the Perſians; and, through the intereſt of his ſon-in-law, Amyntas obtained the country in the neighbourhood of mount Hæmus and Olympus, at the ſame time that the city of Alabanda in Phrygia was given to Amyntas the nephew of Alexander. The Macedonians diſtinguiſhed themſelves in the time of

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of the Perſian invaſion of Greece, by furniſhing their allies with 200,000 recruits; though ſome cities, particularly Potidæa, Olynthus, and Pallene, adhered to the Grecian intereſt. The two laſt were taken and raſed, and the inhabitants maſſacred by the Perſians; but Potidæa eſcaped by reaſon of the ſea breaking into the Perſian camp, where it did great damage. Alexander, however, afterwards thought proper to court the favour of the Greeks by giving them intelligence of the time when Mardonius deſigned to attack them. The remaining tranſactions of this reign are entirely unknown, farther than that he enlarged his dominions to the river Neſſus on the eaſt and the Axius on the weſt.

9 Reign of Perdiccas II.

Alexander I. was ſucceeded by his ſon Perdiccas II. who, according to Dr Gillies, "inherited his father's abilities, though not his integrity." But from his duplicity above mentioned both to Greeks and Perſians, it does not appear that he had much to boaſt of as to the latter quality. In the Peloponneſian war he eſpouſed the cauſe of the Spartans againſt the Athenians, from whom he was in danger by reaſon of their numerous ſettlements on the Macedonian coaſt, and their great power by ſea. For ſome time, however, he amuſed the Athenians with a ſhow of friendſhip; but at laſt, under pretence of enabling Olynthus and ſome other cities to recover their liberties, he aſſiſted in deſtroying the influence of the Athenians in thoſe places, in hopes of eſtabliſhing that of the Macedonians in its ſtead. But this deſign failed of ſucceſs; the Olynthian confederacy was broken, and the members of it became ſubject to Sparta, until at laſt, by the misfortunes of that republic, they became ſufficiently powerful not only to reſiſt the encroachments of the Macedonians, but to make conſiderable conqueſts in their country.

10 Of Archelaus I.

Perdiccas II. was ſucceeded about 416 B. C. by Archelaus I. He enlarged his dominions by the conqueſt of Pydna, and other places in Pieria, though his ambition ſeems rather to have been to improve his dominions than greatly to extend them. He facilitated the communication between the principal towns of Macedon, by cutting ſtraight roads through moſt part of the country: he built walls and fortreſſes in ſuch places as afforded a favourable ſituation; encouraged agriculture and the arts, particularly thoſe ſubſervient to war; formed magazines of arms; raiſed and diſciplined a conſiderable body of cavalry; and in a word, ſays Dr Gillies, added more to the ſolid grandeur of Macedon than had been done by all his predeceſſors put together. Nor was he regardleſs of the arts of peace. His palace was adorned by the works of Grecian painters. Euripides was long entertained at his court; Socrates was earneſtly ſolicited to live there, after the example of this philoſophic poet, formed by his precepts and cheriſhed by his friendſhip: men of merit and genius in the various walks of literature and ſcience were invited to reſide in Macedon, and treated with diſtinguiſhed regard by a monarch duly attentive to promote his own glory and the happineſs of his ſubjects."

11 The kingdom becomes a prey to civil diſſenſions.

This great monarch died after a reign of ſix years, a ſpace by far too ſhort to accompliſh the magnificent projects he had formed. After his death the kingdom fell under the power of uſurpers or weak and wicked monarchs. A number of competitors conſtantly appeared for the throne; and theſe by turns called in to their aſſiſtance the Thracians, Illyrians, Theſſalians; the Olynthian confederacy, Athens, Sparta, and Thebes. Bardyllis, an active and daring chief, who, from being head of a gang of robbers, had become ſovereign of the Illyrians, entered Macedon at the head of a numerous army, depoſed Amyntas II. the father of Philip, and ſet up in his place one Argæus, who conſented to become tributary to the Illyrians. Another candidate for the throne, named *Pauſanias*, was ſupported by the Thracians; but, by the aſſiſtance of the Theſſalians and Olynthians, Amyntas was enabled to reſume the government. After his reſtoration, however, the Olynthians refuſed to deliver up ſeveral places of importance belonging to Macedon which Amyntas had either entruſted to their care, or which they had taken from his antagoniſt. Amyntas complained to Sparta; and that republic, which had already formed ſchemes of very extenſive ambition, ſo readily complied with the requeſt, that it was generally ſuppoſed to have proceeded from Spartan emiſſaries ſent into Macedonia. They pretended indeed to heſitate a little, and to take time to deliberate on the army which ought to be raiſed for the purpoſe; but Cleigenes, the principal ambaſſador, repreſented the urgency of the caſe in ſuch a manner, that the troops which happened at that time to be ready were ordered to take the field without delay. Two thouſand Spartans, under the command of Eudamidas, were ordered into Macedon, while a powerful reinforcement under the command of Phœbidas, brother to the general, was ordered to follow him as ſoon as poſſible. By accident, Phœbidas and his auxiliaries were detained till the ſeaſon for action was paſſed; but Eudamidas with his ſmall army performed very eſſential ſervice. The appearance of a Spartan army at once encouraged the ſubjects and allies of the Olynthians to revolt; and the city of Potidæa, a place of great importance in the iſthmus of Pallene, ſurrendered ſoon after his arrival in the country. Being too much elated with his ſucceſs, however, Eudamidas approached ſo near the city of Olynthus, that he was unexpectedly attacked, defeated, and killed in a ſally of the citizens. He was ſucceeded by Teleutias the brother of Ageſilaus, who had under his command a body of 10,000 men, and was farther aſſiſted by Amyntas king of Macedon and Derdas his brother, the governor or ſovereign of the moſt weſterly province of Macedon, which abounded in cavalry. By theſe formiable enemies the Olynthians were defeated in a number of battles, obliged to ſhut themſelves up in their city, and prevented from cultivating their territory; on which Teleutias advanced with his whole forces to inveſt the city itſelf. His exceſſive eagerneſs to deſtroy his enemies proved his ruin. A body of Olynthian horſe had the boldneſs to paſs the river Amnias in ſight of the allied army, though ſo much ſuperior in number. Teleutias ordered his targeteers to attack them, the Olynthians, having retreated acroſs the river, were cloſely purſued by the Lacedemonians, great part of whom alſo paſſed the river; but the Olynthians ſuddenly turning upon them, killed upwards of 100, with Tlemonidas their leader. Teleutias, exaſperated at this diſaſter,

12 War with the Olynthians.

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ordered the remainder of the targeteers and cavalry to purſue; while he himſelf advanced at the head of the heavy armed foot with ſuch celerity that they began to fall into diſorder. The Olynthians allowed them to proceed, and the Lacedæmonians very imprudently advanced juſt under the towers and battlements of the city. The townſmen then mounted the walls, and diſcharged upon them a ſhower of darts, arrows, and other miſſile weapons, while the flower of the Olynthian troops, who had been purpoſely poſted behind the gates, ſallied forth and attacked them with great violence. Teleutias attempting to rally his men, was ſlain in the firſt onſet; the Spartans who attended him were defeated, and the whole army at laſt diſperſed with great ſlaughter, and obliged to ſhelter themſelves in the towns of Acanthus, Apollonia, Spartolus, and Potidæa.

The Spartans, undiſmayed by this terrible diſaſter, next ſent their King Ageſipolis with a powerful reinforcement into Macedon. His preſence greatly raiſed the ſpirits of the Lacedæmonian allies, and his rapid ſucceſs ſeemed to promiſe a ſpeedy termination to the war, when he himſelf died of a calenture. He was ſucceeded in the throne by his brother Cleombrotus, and in the command of the army by Polybiades an experienced general, who likewiſe brought along with him a powerful reinforcement. Olynthus was now completely blocked up by land, while a ſquadron of Lacedæmonian galleys blocked up the neighbouring harbour of Myceberna. The Olynthians, however, held out for nine or ten months, but at laſt were obliged to ſubmit on very humiliating conditions. They formally renounced all claim to the dominion of Chalcis; they ceded the Macedonian cities to their ancient governor; and in conſequence of this Amyntas left the city of Ægæa or Edeſſa, where till now he had held his royal reſidence, and fixed it at Pella, a city of great ſtrength and beauty, ſituated on an eminence, which together with a plain of conſiderable extent was defended by impaſſable moraſſes, and by the rivers Axius and Lydias. It was diſtant about 15 miles from the Ægean ſea, with which it communicated by means of the abovementioned rivers. It was originally founded by the Greeks, who had lately conquered and peopled it; but in conſequence of the misfortunes of Olynthus, it now became the capital of Macedon, and continued ever after to be ſo.

13 The Olynthians obliged to ſubmit.

14 Pella made the capital of Macedon.

Amyntas, thus fully eſtabliſhed in his dominions, continued to enjoy tranquillity during the remaining part of his life. The reign of his ſon Alexander was ſhort, and diſturbed by invaſions of the Illyrians; from whom he was obliged to purchaſe a peace. He left behind him two brothers, Perdiccas and Philip, both very young; ſo that Pauſanias again found means to uſurp the throne, being ſupported not only by the Thracians, but a conſiderable number of Greek mercenaries, as well as a powerful party in Macedon itſelf. In this critical juncture, however, Iphicrates the Athenian happening to be on an expedition to Amphipolis, was addreſſed by Eurydice the widow of Amyntas, ſo warmly in behalf of her two ſons, whom ſhe preſented to him, that he intereſted himſelf in their behalf, and got Perdiccas the eldeſt eſtabliſhed on the throne. He was induced alſo to this piece of generoſity by the kindneſs which Eurydice and her huſband had formerly ſhown to himſelf, and he likewiſe ſaw the advantages which muſt enſue to his country from a connection with Macedon. During the minority of the young prince, however, his brother Ptolemy, who was his guardian, openly aſpired to the throne; but he was depoſed by the Theban general Pelopidas, who reinſtated Perdiccas in his dominions; and in order to ſecure, in the moſt effectual manner, the dependence of Macedon upon Thebes, carried along with him thirty Macedonian youths as hoſtages; and among them Philip, the younger brother of the king. Perdiccas now, elated by the protection of ſuch powerful allies, forgot Iphicrates and the Athenians, and even diſputed with them the right to the city of Amphipolis, which had been decreed to them by the general council of Greece, but which his oppoſition rendered impoſſible for them to recover. In conſequence of the truſt he put in theſe new allies, alſo, it is probable that he refuſed to Bardyllis the Illyrian the tribute which the Macedonians had been obliged to pay him; which occaſioned a war with that nation. In this conteſt the Macedonians were defeated with the loſs of 4000 men, Perdiccas himſelf being taken priſoner, and dying ſoon after of his wounds.

15 Pauſanias uſurps the throne.

16 Ptolemy aſpires to the throne.

17 The Macedonians defeated, and their king killed by the Illyrians.

The kingdom was now left in the moſt deplorable ſtate. Amyntas, the proper heir to the throne, was an infant; the Thebans, in whom Perdiccas had placed ſo much confidence, were deprived of the ſovereignty of Greece; the Athenians, juſtly provoked at the ungrateful behaviour of the late monarch, ſhowed an hoſtile diſpoſition; the Illyrians ravaged the weſt, and the Pæonians the north quarter of the kingdom; the Thracians ſtill ſupported the cauſe of Pauſanias, and propoſed to ſend him into Macedon at the head of a numerous army; while Argæus, the former rival of Amyntas, renewed his pretenſions to the throne, and by flattering the Athenians with the hopes of recovering Amphipolis, eaſily induced them to ſupport his claims; and in conſequence of this they fitted out a fleet, having on board 3000 heavy armed ſoldiers, which they ſent to the coaſt of Macedon.

18 Philip arrives in Macedon.

Philip, the late king's brother, no ſooner heard of his defeat and death, than he ſet out privately from Thebes; and on his arrival in Macedon found matters in the ſituation we have juſt now deſcribed. Fired with an inſatiable ambition, it is very probable that from the very firſt moment he had reſolved to ſeize the kingdom for himſelf; yet it was neceſſary at firſt to pretend that he aſſumed the throne only to preſerve it for his nephew. Philip, as has already been mentioned, was carried off as an hoſtage by Pelopidas, but for a long time paſt had remained in ſuch obſcurity, that hiſtorians diſagree as to his place of reſidence; ſome placing him in Thebes, and others in Macedon. It is certain, however, that from the age of 15 he had been very much in the family of Epaminondas, from whoſe leſſons he could not but derive the greateſt emolument. It is probable alſo that he attended this celebrated general in many of his expeditions; and it is certain, that, with an attendance ſuitable to his rank, he viſited moſt of the principal republics, and ſhowed an attention to their inſtitutions, both civil and military, far ſuperior to his years. Having eaſy acceſs to whomſoever he pleaſed, he cultivated the friendſhip of the firſt people in Greece. Even in Athens, where

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where no good-will ſubſiſted with Macedon, the philoſophers Plato, Iſocrates, and Ariſtotle, cultivated his acquaintance: and the connection he formed with the principal leaders of that republic in the early period of his life, no doubt contributed greatly to the accompliſhment of the deſigns in which he afterwards proved ſo ſucceſsful. His appearance in Macedon inſtantly changed the face of affairs: the Macedonian army, though defeated, was not entirely deſtroyed; and the remainder of them ſecured themſelves in the fortreſſes which had been built by Archelaus. There were alſo conſiderable garriſons in the fortreſſes, and walled towns ſcattered over the kingdom; and the Illyrians, who had made war only for the ſake of plunder, ſoon returned home to enjoy the fruits of their victory. His other enemies, the Thracians and Pæonians, were much leſs formidable than the Illyrians, being ſtill in a very rude and uncivilized ſtate, incapable of uniting under one head in ſuch a manner as to bring any formidable army into the field. While the Illyrians therefore gave up the campaign through mere caprice and unſteadineſs, Philip himſelf applied to the Pæonians, and by fair promiſes and flattery prevailed upon them to deſiſt. The king of Thrace, by means of a ſum of money, was eaſily prevailed upon to abandon the cauſe of Pauſanias; ſo that Philip, freed from theſe barbarians, was now left at liberty to oppoſe the Athenians, who ſupported Argæus, and threatened a very formidable invaſion.

19 Retrieves the affairs of the kingdom.

The appearance of the Athenian fleet before Methone, with that of Argæus at the head of a numerous army in Pieria, filled the whole country with conſternation; and Philip, who was by no means deficient in talents neceſſary to recommend himſelf to the good graces of the people, took the opportunity of getting Amyntas ſet aſide, and himſelf declared king; for which indeed the danger of the times afforded a very plauſible pretext. Argæus, in the mean time, advanced with his Athenian allies towards Edeſſa, or Ægæ, the ancient capital of the Macedonian empire, where he hoped to have been amicably received; but finding the gates ſhut againſt him, he returned back to Methone. Philip haraſſed him in his retreat, cutting off great numbers of his men, and afterwards defeated him in a general engagement; in which Argæus himſelf, with the flower of his army, was cut in pieces, and all the reſt taken priſoners.

20 Takes upon him the ſovereignty.

21 Defeats and kills Argæus an uſurper.

This firſt inſtance of ſucceſs contributed greatly to raiſe the ſpirits of Philip's party; and he himſelf took care to improve it in the beſt manner poſſible. Having taken a great number of priſoners, both Macedonians and Athenians, he determined, by his treatment of them, to ingratiate himſelf with both parties. The former were called into his preſence, and, after a gentle reprimand, admitted to ſwear allegiance to him; after which they were diſtributed through the army: the Athenians were entertained at his table, diſmiſſed without ranſom, and their baggage reſtored. The priſoners were juſt allowed time to return to their native city and to ſpread abroad the news of Philip's generoſity, when they were followed by ambaſſadors from Macedon with propoſals for peace. As he knew that the loſs of Amphipolis had greatly irritated them, he now thought proper to renounce his juriſdiction over that city; and it was accordingly declared free and independent, and ſubject only to the government of its own free and equitable laws. This artful conduct, together with his kind treatment of the priſoners, ſo wrought upon the minds of the Athenians, that they conſented to the renewal of a treaty which had formerly ſubſiſted between them and his father Amyntas. Thus he found means to remove all jealouſy of his ambition or the ſchemes he might afterwards undertake to their prejudice; and not only this, but to induce them to engage in a ruinous war with their allies, which occupied their attention until Philip had an opportunity of getting his matters ſo well eſtabliſhed that it was impoſſible to overthrow them.

22 Philip's politic treatment of the priſoners.

23 Renounces his right to Amphipolis.

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24 Reduces the power of the nobility.

The new king being thus left at liberty to regulate his domeſtic concerns, began to circumſcribe the power of his chiefs and nobles; who, eſpecially in the more remote provinces, paid very little regard to the authority of the kings of Macedon; ſometimes, even in times of public calamity, throwing off their allegiance altogether, and aſſuming an independent government over conſiderable tracts of country. To counteract the ambition of theſe chiefs, Philip choſe a body of the braveſt Macedonian youths, whom he entertained at his own table, and honoured with many teſtimonies of his friendſhip, giving them the title of his *companions*, and allowing them conſtantly to attend him in war and hunting. Their intimacy with the ſovereign, which was conſidered as an indication of their merit, obliged them to ſuperior diligence in all the ſevere duties of military diſcipline; and the young nobility, eager to participate ſuch high honours, vied with each other in their endeavours to gain admiſſion into this diſtinguiſhed order; ſo that while on the one hand they ſerved as hoſtages, on the other they formed an uſeful ſeminary for future generals, by whom both Philip and Alexander were afterwards greatly aſſiſted in their conqueſts.

25 Chooſes a number of illuſtrious young men for his companions.

26 Whether he inſtituted the phalanx.

Diodorus Siculus, and all the Roman writers who have treated of the hiſtory of Greece, aſſert that Philip, in the firſt year of his reign, inſtituted the Macedonian phalanx; a body of 6000 men armed with ſhort ſwords fitted either for cutting or ſtabbing, having alſo ſtrong bucklers four feet long and two and an half broad, and pikes 14 feet long; uſually marching 16 men deep. But this opinion is controverted by others. Dr Gillies ſuppoſes that the opinion had ariſen from the Romans meeting with the phalanx in its moſt complete form in Macedon; and as they became acquainted with Greece and Macedon pretty nearly at the ſame time, it was natural for them to ſuppoſe that it had been invented among the Macedonians. The phalanx, he ſays, is nothing different from the armour and arrangement which had always prevailed among the Greeks, and which Philip adopted in their moſt perfect form; "nor is there reaſon (ſays he) to think that a prince, who knew the danger of changing what the experience of ages had approved, made any alteration in the weapons or tactics of that people. The improvement in the countermarch, to which Philip gave the appearance of advancing inſtead of retreating, mentioned by Ælian in his Tactics, c. xxviii. was borrowed, as this author tells us, from the Lacedæmonians. If Philip increaſed the phalanx, uſually leſs numerous, to 6000 men, this was far from an improvement; and the later kings of

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Macedon, who ſwelled it to 16,000, only rendered that order of battle more unwieldy and inconvenient." Inſtead of this, Philip, according to our author, employed himſelf in procuring arms, horſes, and other neceſſary materials for war; and in introducing a more ſevere and exact military diſcipline than had formerly been known in Macedon.

27 Overcomes the Pæonians and Illyrians.

While the king thus took the beſt methods to render himſelf ſecure at home and formidable abroad, the Pæonians again began to make incurſions into the kingdom. The death of Agis their king, however, who was a man of great military ſkill, deprived them almoſt of every power of reſiſtance when they were attacked. Philip, of conſequence, over-ran their country with little oppoſition, and reduced them to the ſtate of tributaries to Macedon. No ſooner was this accompliſhed, than he undertook a winter's campaign againſt the Illyrians, who had long been the natural enemies of Macedon. They had now extended their territory to the eaſt; by which means the Macedonians were excluded from the harbours on the coaſt of the Adriatic. This was a grievance to Philip, who ſeems early to have meditated the raiſing of a naval power; neither could he hope to be in ſafety, ſhould the kingdom be left open to the incurſions of a barbarous enemy: for which reaſons he determined at once to humble thoſe enemies in ſuch a manner that they ſhould no longer be in a ſituation to give him any diſturbance. After an ineffectual negociation, he was met by Bardyllis at the head of a conſiderable body of infantry, but with only 400 horſe. They made a gallant reſiſtance for ſome time; but being unable to cope with ſuch a ſkilful general as Philip, they were defeated with the loſs of 7000 men, among whom was their leader Bardyllis, who fell at the age of 90.

28 They are forced to become tributary.

By this diſaſter the Illyrians were ſo much diſheartened, that they ſent ambaſſadors to Philip, humbly begging for peace on any terms. The conqueror granted them the ſame conditions which had been impoſed upon the Pæonians, viz. the becoming tributary, and yielding up to him a conſiderable part of their country. That part of it which lay to the eaſtward of a lake named Lychnidus he annexed to Macedon; and probably built a town and ſettled a colony there; the country being fertile, and the lake abounding with many kinds of fiſh highly eſteemed by the ancients. This town and lake were about 50 miles diſtant from the Ionian ſea; and ſuch was the aſcendency which the arms and policy of Philip acquired over his neighbours, that the inhabitants of all the intermediate diſtrict ſoon adopted the language and manners of their conquerors; and their territory, hitherto unconnected with any foreign power, ſunk into ſuch abſolute dependence upon Macedon, that many ancient geographers ſuppoſed it to be a province of that country.

29 His great deſigns.

Philip had no ſooner reduced the Illyrians, than he began to put in execution greater deſigns than any he had yet attempted. The rich coaſts to the ſouthward of Macedon, inhabited chiefly by Greeks, preſented a ſtrong temptation to his ambition and avarice. The confederacy of Olynthus, after having thrown off the yoke of Sparta, was become more powerful than ever, and could ſend into the field an army of 10,000 heavy armed troops, beſides a number of cavalry in proportion. Moſt of the towns in Chalcidice were become its allies or ſubjects; ſo that this populous and wealthy province, together with Pangæus on the right and Pieria on the left, of both which the cities were either independent or ſubject to the Athenians, formed a barrier not only ſufficient to guard againſt any incurſions of the Macedonians, but which was even formidable to them. But though Philip was ſenſible enough of the importance of thoſe places, he conſidered the conqueſt of Amphipolis as more neceſſary at the preſent time. By the poſſeſſion of this place Macedon would be connected with the ſea, and would be ſecured in many commercial advantages, which could not but contribute greatly to the proſperity of the kingdom at large; a road was likewiſe opened to the woods and mines of Pangæus, the former of which were ſo neceſſary to the raiſing of a naval power, and the latter for the eſtabliſhment of a proper military force. This city had indeed been declared independent by Philip himſelf in the beginning of his reign; but this was only to prevent a rupture with the Athenians, who ſtill aſſerted their right to it as an ancient colony; though, by reaſon of the perfidy of Charidemus, a native of Eubœa, they had hitherto failed in their attempts to recover it. The Amphipolitans, however, having once enjoyed the ſweets of liberty, prepared to maintain themſelves in their independence. In the mean time the hoſtile deſigns of Philip, which all his precaution had not been able to conceal, alarmed the inhabitants to ſuch a degree, that they thought proper to put themſelves under the protection of the Olynthians. By them they were readily received into the confederacy; and, truſting to the ſtrength of their new allies, behaved in ſuch an inſolent manner to Philip, that he was not long of finding a ſpecious pretext for hoſtility; at which the Olynthians, greatly alarmed, ſent ambaſſadors to Athens, requeſting their aſſiſtance againſt ſuch a powerful enemy. Philip, however, juſtly alarmed at ſuch a formidable conſpiracy, ſent agents to Athens, with ſuch expedition that they arrived there before any thing could be concluded with the Olynthian deputies. Having gained over the popular leaders and orators, he deceived and flattered the magiſtrates and ſenate in ſuch an artful manner, that a negociation was inſtantly ſet on foot, by which Philip engaged to conquer Amphipolis for the Athenians, upon condition that they ſurrendered to him the ſtrong fortreſs of Pydna, a place which he repreſented as of much leſs importance to them; promiſing alſo to confer upon them many other advantages, which, however, he did not ſpecify at that time. Thus the Athenians, deceived by the perfidy of their own magiſtrates, elated with the hopes of recovering Amphipolis, and outwitted by the ſuperior policy of Philip, rejected with diſdain the proffers of the Olynthians.

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30 Plans the conqueſt of Amphipolis.

31 Engages to conquer it for the Athenians.

The ambaſſadors of Olynthus returned home highly diſguſted with the reception they had met with; but had ſcarce time to communicate the news to their countrymen, when the ambaſſadors of Philip arrived at Olynthus. He pretended to condole with them on the affront they had received at Athens; but teſtified his ſurpriſe that they ſhould court the aſſiſtance of that diſtant and haughty republic, when they could avail themſelves of the powerful kingdom of Macedon, which wiſhed

Macedon. wiſhed for nothing more than to enter into equal and laſting engagements with their confederacy. As a proof of his moderation and ſincerity, he offered to put them in poſſeſſion of Anthemus, an important town in the neighbourhood, of which the Macedonians had long claimed the juriſdiction, making many other fair promiſes; and among the reſt, that he would reduce for them the cities of Pydna and Potidæa, which he choſe rather to ſee in dependence on Olynthus than Athens. Thus he prevailed upon the Olynthians not only to abandon Amphipolis, but to aſſiſt him with all their power in the execution of his deſigns.

Philip now loſt no time in executing his purpoſes on Amphipolis; and preſſed the city ſo cloſely, that the people were glad to apply to the Athenians for relief. Accordingly they diſpatched two of their moſt eminent citizens, Hierax and Stratocles, to repreſent the danger of an alliance betwixt Philip and the Olynthians, and to profeſs their ſorrow for having ſo deeply offended the parent ſtate. This repreſentation had ſuch an effect, that though the Athenians were then deeply engaged in the ſocial war, they would probably have paid ſome attention to the Amphipolitans, had not Philip taken care to ſend them a letter with freſh aſſurances of friendſhip, acknowledging their right to Amphipolis, and which he hoped ſhortly to put into their hands in terms of his recent agreement. By theſe ſpecious pretences the Athenians were perſuaded to pay as little regard to the deputies of the Amphipolitans as they had already done to thoſe of the Olynthians; ſo that the city, unable to defend itſelf alone againſt ſo powerful an enemy, ſurrendered at laſt at diſcretion in the year 357 B. C.

32 Amphipolis ſurrenders.

Philip ſtill proceeded in the ſame cautious and politic manner in which he had begun. Though the obſtinate defence of the Amphipolitans might have furniſhed a pretence for ſeverity, he contented himſelf with baniſhing a few of the popular leaders from whom he had moſt cauſe to dread oppoſition, treating the reſt of the inhabitants with all manner of clemency; but took care to add Amphipolis to his own dominions, from which he was determined that it never ſhould be ſeparated, notwithſtanding the promiſes he had made to the Athenians. Finding that it was not his intereſt at this time to fall out with the Olynthians, he cultivated the friendſhip of that republic with great aſſiduity; took the cities of Pydna and Potidæa, which he readily yielded to the Olynthians, though they had given him but litle aſſiſtance in the reduction of theſe places. Potidæa had been garriſoned by the Athenians; and them the artful king ſent back without ranſom, lamenting the neceſſity of his affairs which obliged him, contrary to his inclination, to oppoſe their republic. Though this was rather too groſs, the Athenians at preſent were ſo much engaged with the ſocial war, that they had not leiſure to attend to the affairs of other nations. Philip made the beſt uſe of his time, and next projected the conqueſt of the gold mines of Thrace. That rich and fertile country was now held by one Cotys, a prince of ſuch weak intellectual faculties, that the ſuperſtition of the Greeks, into which he was newly initiated, had almoſt entirely ſubverted his reaſon; and he wandered about in queſt of the goddeſs Minerva, with whom he fancied himſelf in love. The invaſion of the Macedonians, however,

33 Makes himſelf maſter of the gold mines of Thrace.

awaked him from his reverie; and Cotys, finding himſelf deſtitute of other means of oppoſition, attempted to ſtop the progreſs of the enemy by a letter. To this Philip paid no regard: the Thracians were inſtantly expelled from their poſſeſſions at Crenidæ, where there were very valuable gold mines. Theſe had formerly been worked by colonies from Thaſos and Athens; but the coloniſts had long ſince been expelled by the barbarous Thracians, who knew not how to make uſe of the treaſure they were in poſſeſſion of. Philip took the trouble to deſcend into the mines himſelf, in order to inſpect the works; and having cauſed them to be repaired, planted a Macedonian colony at Crenidæ, beſtowed upon it the name of Philippi, and drew annually from the gold mines to the value of near 1000 talents, or 200,000 l. ſterling; an immenſe ſum in thoſe days. The coins ſtruck here were likewiſe called Philippi.

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34 Settles the affairs of Theſſaly greatly to his advantage.

Philip having obtained this valuable acquiſition, next took upon him to ſettle the affairs of Theſſaly, where every thing was in confuſion. This country had been formerly oppreſſed by Alexander tyrant of Pheræ; after whoſe death three others appeared, *viz.* Tiſiphornus, Pitholaus, and Lycophron, the brothers-in-law of Alexander, who had likewiſe murdered him. By the united efforts of the Theſſalians and Macedonians, however, theſe uſurpers were eaſily overthrown, and effectually prevented from making any diſturbances for the future; and the Theſſalians, out of a miſtaken gratitude, ſurrendered to Philip all the revenues ariſing from their fairs and towns of commerce, as well as all the conveniencies of their harbours and ſhipping; a conceſſion which Philip took care to ſecure in the moſt effectual manner.

Having now not only eſtabliſhed his ſovereignty in the moſt effectual manner, but rendered himſelf very powerful and formidable to his neighbours, Philip determined to enjoy ſome repoſe from his fatigues. Having formed an alliance with Arybbas king of Epirus, he, in the year 357 B. C. married Olympias the ſiſter of that prince; a match thought the more eligible, as the kings of Epirus were ſuppoſed to be deſcended from Achilles. The nuptials were ſolemnized at Pella with great pomp, and ſeveral months were ſpent in ſhows and diverſions; during which Philip ſhowed ſuch an extreme proneneſs to vice of every kind, as diſgraced him in the eyes of his neighbours, and moſt probably laid the foundation of his future domeſtic unhappineſs. So much was this behaviour of the Macedonian monarch taken notice of by the neighbouring ſtates, that the Pæonians and Illyrians threw off the yoke, engaging in their ſchemes the king of Thrace: and notwithſtanding the inſane ſtate of that prince, their deſigns were now carried on with more judgment than was uſual with barbarians. Philip, however, notwithſtanding his diſſipation, got warning of his danger in ſufficient time to prevent the bad conſequences which might have enſued had the confederates got time to bring their matters to a proper bearing. Early in the ſpring 356 he took the field with the flower of the Macedonian troops. Having marched in perſon againſt the Pæonians and Thracians, he diſpatched Parmenio his beſt general into Illyria. Both enterpriſes proved ſucceſsful; and while Philip returned victorious from Thrace, he received an account of the

35 Marries Olympias.

36 A general combination of the neighbouring princes formed againſt him.

37 Defeats his enemies.

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victory gained by Parmenio; a ſecond meſſenger informed him of a victory gained by his chariot at the Olympic games; and a third, that Olympias had been delivered of a ſon at Pella. This was the celebrated Alexander, to whom the diviners propheſied the higheſt proſperity and glory, as being born in ſuch auſpicious circumſtances.

38 Birth of Alexander the Great.

A ſhort time after the birth of Alexander, Philip wrote a letter to the philoſopher Ariſtotle, whom he choſe for preceptor to his young ſon. The letter was written with great brevity, containing only the following words: "Know that a ſon is born to us. We thank the gods not ſo much for their gift, as for beſtowing it at a time when Ariſtotle lives. We aſſure ourſelves that you will form him a prince worthy of his father, and worthy of Macedon." He next ſet about the farther enlargement of his territories, which were already very conſiderable. Pæonia was now one of his provinces; on the eaſt his dominions extended to the ſea of Thaſos, and on the weſt to the lake Lychnidus. The Theſſalians were in effect ſubject to his juriſdiction, and the poſſeſſion of Amphipolis had ſecured him many commercial advantages; he had a numerous and well-diſciplined army, with plentiful reſources for ſupporting ſuch an armament, and carrying through the other ſchemes ſuggeſted by his ambition; though his deep and impenetrable policy rendered him more truly formidable than all theſe put together. His firſt ſcheme was the reduction of Olynthus, the moſt populous and fertile country on the borders of Macedon; after which his ambition prompted him to acquire the ſovereignty of all Greece. To accompliſh the former, he had hitherto courted the friendſhip of the Olynthians by every poſſible method; and without letting ſlip any opportunity to acompliſh the latter, he deprived the Athenians gradually of ſeveral of their ſettlements in Thrace and Macedon. In theſe depredations, however, he took care always to give ſuch appearance of juſtice to his actions, that his antagoniſts, who had ſtudied the matter leſs deeply, could not find a plauſible pretext for engaging in war againſt him, even when he had openly committed hoſtilities againſt them. Philip eaſily perceived that the affairs of the Greeks were coming to a criſis, and he determined to wait the event of their mutual diſſentions. That event did not diſappoint his hopes. The Phocians had violated the religion of thoſe days in a moſt extraordinary manner; they had even ploughed up the lands conſecrated to Apollo: and however they might pretend to excuſe themſelves by examples, the Amphictyons fulminated a decree againſt the Phocians, commanding the ſacred lands to be laid waſte, and impoſing an heavy fine upon the community.

39 Ariſtotle appointed his preceptor.

40 Extent of the Macedonian territories.

41 Projects the conqueſt of Olynthus and of all Greece.

42 Account of the Phocian war.

By this decree all Greece was again involved in the war called *Phocian*, from the name of the city about which it commenced. Philip at the beginning of the troubles was engaged in Thrace, where a civil war had taken place among the ſons of Cotys; and wherever Philip interfered, he was ſure to make matters turn out to his own advantage. His incroachments at length became ſo enormous, that Kerſobletes, the moſt powerful of the contending princes, agreed to cede the Thracian Cherſoneſus to the Athenians; who immediately ſent Chares at the head of a powerful armament to take poſſeſſion of it. In this expedition the town of Seſtos was taken by ſtorm, and the inhabitants cruelly treated by Chares, while Philip employed himſelf in the ſiege of Methone in Pieria. This city he likewiſe reduced; but the king loſt an eye at the ſiege in the following extraordinary manner, if we may give credit to ſome ancient hiſtorians. A celebrated archer, named After, had it ſeems offered his ſervices to Philip, being repreſented as ſuch an excellent markſman, that he could hit the ſwifteſt bird on the wing. Philip replied, that he would be of excellent uſe if they were to make war with ſtarlings. After, diſguſted with this reception, went over to the enemy, and with an arrow wounded the king in the eye. When the weapon was extracted, it was found to have on it the following inſcription: "For the right eye of Philip." The king ordered the arrow to be ſhot back again, with another inſcription, importing that he would cauſe After to be hanged when the town was taken. A report was raiſed after Philip's death, that he had loſt his eye by prying too narrowly into the amours of Olympias and Jupiter Ammon; which the vanity of his ſucceſſor prompted him to cheriſh, as his flatterers had probably been the inventors of it.

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43 Philip loſes an eye at the ſiege of Methone.

All this time the Phocian war raged with the greateſt fury, and involved in it all the ſtates of Greece. Lycophron, one of the Theſſalian tyrants, whom Philip had formerly deprived of his authority, had again found means to re-eſtabliſh his authority; and his countrymen having taken part with the Phocians, Lycophron called in Onomarchus the Phocian general to protect him againſt the power of Philip, by whom he was ſenſible that he would ſoon be attacked. The king accordingly marched into Theſſaly with a conſiderable army, defeated Phyallus the brother of Onomarchus, whom the latter had ſent into the country with a detachment of 7000 men. After this he beſieged and took the city of Pegaſæ, driving the enemy towards the frontiers of Phocis. Onomarchus then advanced with the whole army; and Philip, though inferior in numbers, did not decline the engagement. The Phocians at firſt gave ground, on which the Macedonians purſued, but in good order; but coming near a precipice, on the top of which Onomarchus had poſted a detachment of ſoldiers, the latter rolled down ſtones and fragments of the rock in ſuch a manner as did dreadful execution, and threw them into the utmoſt diſorder. Philip, however, rallied his troops with great preſence of mind, and prevented the Phocians from gaining any farther advantage than they had already done; ſaying, as he drew off his men, that they did not retreat through fear, but like rams, in order to ſtrike with the greater vigour. Nor was he long before he made good his aſſertion; for having recruited his army with the greateſt expedition, he returned into Theſſaly at the head of 20,000 foot and 500 horſe, where he was met by Onomarchus. The Macedonians at this time were ſuperior in number to their enemies; and Philip moreover took care to remind them, that their quarrel was that of heaven, and that their enemies had been guilty of ſacrilege, by profaning the temple of Delphi. That they might be ſtill more animated in the cauſe, he put crowns of laurel on their heads. Thus fired by enthuſiaſm, and having beſides the advantage of numbers, the Phocians were altogether unable to withſtand them. They threw away their

44 Is engaged in a war with Onomarchus the Phocian general,

45 Who defeats him;

46 But is at laſt defeated and killed.

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their arms and fled towards the ſea, where they expected to have been relieved by Chares, who, with the Athenian fleet, was nigh the ſhore: but in this they were diſappointed, for he made no attempt to ſave them. Upwards of 6000 periſhed in the field of battle or in the purſuit, and 3000 were taken priſoners. The body of Onomarchus being found among the ſlain, was by order of Philip hung up on a gibbet as a mark of infamy, on account of his having polluted the temple; the bodies of the reſt were thrown into the ſea, as being all partakers of the ſame crime. The fate of the priſoners is not known, by reaſon of an ambiguity in a ſentence of Diodorus Siculus, which may imply that they were drowned, though it does not expreſsly ſay ſo.

47 Philip purſues his ambitious ſchemes.

After this victory, Philip ſet about the ſettlement of Theſſaly, waiting only for an opportunity to put in execution his favourite ſcheme of invading Greece. In the mean time, he rejoiced to ſee the ſtates weakening each other by their mutual diſſenſions; of which he never failed to take advantage as far as poſſible. He now, however, began to throw off the maſk with regard to the Olynthians, whom he had long deceived with fair promiſes. Having detached Kerſobletes from the intereſt of the Athenians, he eſtabliſhed him in the ſovereignty of Thrace; not out of any good will, but with a view to deſtroy him whenever a proper opportunity offered. Were he once poſſeſſed of the dominions of that prince, the way to Byzantium was open to him; the poſſeſſion of which muſt have been a great temptation to Philip, who well knew how to value the importance of its ſituation both with reſpect to commerce and war: and in order to pave the way to this important conqueſt, he attacked the fortreſs of Heræum, a ſmall and in itſelf unimportant place, though, by reaſon of its neighbourhood to Byzantium, the acquiſition was valuable to Philip. The

48 Is oppoſed by the Athenians.

Athenians, however, at laſt began to perceive the deſigns of Philip, and determined to counteract them. For this purpoſe they entered into an alliance with Olynthus; and having warned Kerſobletes of his danger, they ordered a powerful fleet to the defence of the Heræum. But theſe vigorous meaſures were ſoon counteracted by the report of Philip's death, which had been occaſioned by his wound at Methone, and a diſtemper ariſing from the fatigues he had afterwards undergone. The inconſtant Athenians too eaſily gave credit to this report; and, as if all danger had been over with his death, diſcontinued their preparations, and directed their whole attention to the ſacred war.

49 Continuation of the Phocian war.

—This conteſt, inſtead of being ended by the death of Onomarchus, now raged with double fury. Phyallus, abovementioned, the only ſurviving brother of Onomarchus, undertook the cauſe of the Phocians; and his affairs becoming every day more and more deſperate, he undertook the moſt unaccountable method of retrieving them which could be imagined; having converted into ready money the moſt precious materials belonging to the temple at Delphi, and with this treaſure doubled the pay of his ſoldiers. By this new piece of ſacrilege, he indeed brought many adventurers to his ſtandard, though he cut off all hopes of mercy for himſelf or his party ſhould he be defeated. Having the aſſiſtance of 1000 Lacedemonians, 2000 Achæans, and 5000 Athenian foot, with 400 cavalry, he was ſtill enabled to make a very formidable appearance; and the Phocians took the field with great proſpect of ſucceſs.

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Philip now thought it time to throw off the maſk entirely, for which the proceedings of the Athenians, particularly their league with Olynthus, furniſhed him with a plauſible pretext; and the revenging ſuch horrid ſacrilege as had been committed at Delphi ſeemed to give him a title to march at the head of an army into Greece. The ſuperſtition of the Greeks, however, had not yet blinded them to ſuch a degree, but they could eaſily perceive that Philip's piety was a mere pretence, and that his real deſign was to invade and conquer the whole country. The Athenians no ſooner heard of the march of the Macedonian army, than they diſpatched, with all expedition, a ſtrong guard to ſecure the paſs of Thermopylæ; ſo that Philip was obliged to return greatly chagrined and diſappointed. Their next ſtep was to call an aſſembly, to deliberate upon the meaſures proper to be taken in order to reſtrain the ambition of the Macedonian monarch; and this aſſembly is rendered memorable by the firſt appearance of Demoſthenes as an orator againſt Philip. Athens for ſome time had been in a very alarming ſituation. They were deeply involved in the ſacred war; their northern poſſeſſions were continually inſulted and plundered by Philip; while a number of his mercenary partiſans drew off the public attention to ſuch a degree, that, inſtead of taking meaſures to counteract that ambitious prince, they amuſed themſelves with ſpeculations about the deſigns of the Perſian monarch, who was preparing for war againſt the Cyprians, Egyptians, and Phœnicians. Iſocrates the celebrated orator, and Phocion the ſtateſman, joined the multitude in their preſent opinion, though not from any mercenary motives, but purely from a ſenſe of the unſteady conduct of the Athenians; who, they were aſſured, could not contend with a prince of the vigour and activity of Philip; and therefore exhorted them by all means to cultivate the friendſhip of Philip, whom they could not oppoſe with any probability of ſucceſs. Iſocrates, indeed, greatly wiſhed for an expedition into Aſia, and looked upon Philip to be the only general capable of conducting it, though at preſent the Greeks had no pretence for making war upon the Perſians, but that of revenging former injuries: and on this ſubject he addreſſed a diſcourſe to Philip himſelf; and it is even ſaid, that Iſocrates, by the power of his rhetoric, prevailed upon Philip and the Athenians to lay aſide their animoſities for a ſhort time, and conſent to undertake this expedition in conjunction.

50 Philip engages in the quarrel.

51 Is prevented from entering Greece.

52 Extreme Indolence and careleſſneſs of the Athenians.

53 Advice of Iſocrates the orator to them.

If this coalition, however, did really take place, it was of very ſhort duration. The views of Phocion and Iſocrates were violently oppoſed by Demoſthenes. Though ſenſible of the corruption and degeneracy of his countrymen, he hoped to be able to rouſe them from their lethargy by dint of his eloquence; a talent he had been at great pains to cultivate, and in which he is ſaid to have excelled all men that ever exiſted.

54 He and Phocion are oppoſed by Demoſthenes.

In his firſt addreſſes to the people, this celebrated orator exhorted them to awake from their indolence, and to aſſume the direction of their own affairs. They had been too long governed, he ſaid, by the incapa-

55 Subſtance of his firſt diſcourſes.

city

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city of a few ambitious men, to the great diſadvantage as well as diſgrace of the community. In the firſt place, an orator who had placed himſelf at the head of a faction of no more than 300 or 400, availed himſelf and his followers of the careleſsneſs and negligence of the people to rule them at pleaſure. From a conſideration of their preſent weakneſs and corruption, as well as of the deſigns and commotions of the neighbouring powers, he adviſed them to abandon all romantic and diſtant ſchemes of ambition; and inſtead of carrying their arms into remote countries, to prepare for repelling the attacks which might be made upon their own dominions. He inſiſted alſo upon a better regulation of their finances, a more equal diſtribution of the public burthens, in proportion to the abilities of thoſe upon whom they were laid, and upon the retrenching many ſuperfluous expences. Having pointed out in a ſtrong light the vigorous conduct of Philip; and ſhown by what means he had attained to ſuch a reſpectable footing in the world, he next laid down a proper plan for their military operations. He told them, that they were not yet prepared to meet Philip in the field; they muſt begin with protecting Olynthus and the Cherſoneſus, for which it would be neceſſary to raiſe a body of 2000 light armed troops, with a due proportion of cavalry, which ought to be tranſported under a proper convoy to the iſlands of Lemnos, Thaſos, and Sciathos, in the neighbourhood of Macedon. In theſe they would enjoy all kinds of neceſſaries in abundance, and might avail themſelves of every favourable incident, to appear at the firſt ſummons of their allies; and either to repel the incurſions of the Macedonians, or haraſs their territories. While this was going on, more vigorous preparations might be made for war at home; and it was propoſed, that only the fourth part of the Athenian citizens ſhould enliſt, and no more ſupplies were wanted at preſent but 90 talents. But notwithſtanding the moderation of theſe propoſals, and the urgent neceſſities of the ſtate, it was impoſſible to prevail upon the indolent and careleſs Athenians to provide for their own ſafety. They appear, indeed, at this time, to have been deſperately ſunk in effeminacy and diſſipation; which diſpoſition Philip took care to encourage to the utmoſt of his power. There was an aſſembly in the city called the *Sixty*, from their conſiſting originally of that number, who met expreſsly for the purpoſes of extinguiſhing all care about public affairs, and to intoxicate themſelves with every kind of pleaſure they had in their power. With this aſſembly Philip was ſo well pleaſed, that he ſent them money to ſupport their extravagancies; and ſo effectually did they anſwer his purpoſes, that all the eloquence of Demoſthenes could not counteract the ſpeeches of orators much his inferiors when backed by Macedonian gold.

Philip himſelf, as we have already hinted, was exceſſively debauched in his private character, and the moſt ſhameful ſtories are related of him by the ancient writers, particularly by Demoſthenes. Theopompus too, an author who flouriſhed in the time of Alexander, and was rewarded and honoured by that monarch, alſo ſpeaks of him in ſuch terms as we cannot with decency relate: but theſe accounts, coming from the avowed enemies of the king, are ſcarcely to be credited; and perhaps *policy*, as well as inclination, might contribute ſomewhat to this ſcandalous behaviour, that he might thereby recommend himſelf to the libertines of Athens, and prevent even many of the more thinking part of the people from ſuſpecting his deſigns. But in whatever exceſſes he might at times indulge himſelf, he never loſt ſight of his main object, the ſubjugation of the Greek ſtates. On pretence of being in want of money to defray the expence of his buildings, he borrowed money at a very high price throughout the whole country; and this he found an eaſy matter to do, as the diſſipation of the Delphic treaſures had rendered caſh very plentiful in Greece. Thus he attached his creditors firmly to his own intereſt; and on pretence of paying debts, was enabled without moleſtation to beſtow a number of penſions and gratuities upon the Athenian orators, who by their treacherous harangues contributed greatly to the ruin of their country; at leaſt as far as it could be ruined by ſubjection to a prince who would have obliged them to remain at peace, and apply themſelves to uſeful arts. Theſe he himſelf encouraged in a very eminent degree. The greateſt part of his time was employed at Pella, which city he adorned in the moſt magnificent manner with temples, theatres, and porticoes. He invited, by liberal rewards, the moſt ingenious artiſts in Greece; and as many of theſe met with very little encouragement in their own country, great numbers flocked to him from all quarters. In the government of his people, alſo, Philip behaved with the utmoſt impartiality; liſtening with condeſcenſion to the complaints of the meaneſt of his ſubjects, and keeping up a conſtant correſpondence with thoſe whom he thought worthy of his acquaintance; from which, it is not eaſy to imagine how he could be ſo guilty of the vices we have already mentioned from ſome ancient hiſtorians.

The fate of Olynthus was now ſoon determined. This city, which held the balance of power betwixt Athens and Macedon, was taken and plundered, and the inhabitants ſold for ſlaves; but the chief hope of Philip was in putting an end to the Phocian war. For this purpoſe he affected a neutrality, that he might thereby become the arbiter of Greece. His hopes were well founded; for the Thebans, who were at the head of the league againſt the Phocians, ſolicited him on the one ſide, and the ſtates confederate with the Phocians did the like on the other. He anſwered neither, yet held both in dependence. In his heart he favoured the Thebans, or rather placed his hopes of favouring his own cauſe in that ſtate; for he well knew, that the Athenians, Spartans, and other ſtates allied with Phocis, would never allow him to paſs Thermopylæ, and lead an army into their territories. So much reſpect, however, did he ſhow to the ambaſſadors from theſe ſtates, particularly Cteſiphon and Phrynon, who came from Athens, that they believed him to be in their intereſt, and reported as much to their maſters. The Athenians, who were now diſſolved in eaſe and luxury, received this news with great ſatisfaction; and named immediately ten plenipotentiaries to go and treat of a full and laſting peace with Philip. Among theſe plenipotentiaries were Demoſthenes and Æſchines, the moſt celebrated orators in Athens. Philip gave directions that theſe ambaſſadors ſhould be treated with the utmoſt civility; naming, at the ſame time, three of his

56 Overreaches the Athenians, and at laſt concludes a peace.

Macedon. his miniſters to confer with them, viz. Antipater, Parmenio, and Eurylochus. Demoſthenes being obliged to return to Athens, recommended it to his colleagues not to carry on their negociations with Philip's deputies; but to proceed with all diligence to court, there to confer with the king himſelf. The ambaſſadors, however, were ſo far from following his inſtructions, that they ſuffered themſelves to be put off for three months by the arts of Philip and his miniſters.

In the mean time, the king took from the Athenians ſuch places in Thrace as might beſt cover his frontiers; giving their plenipotentiaries, in their ſtead, abundance of fair promiſes, and the ſtrongeſt aſſurances that his good-will ſhould be as beneficial to them as ever their colonies had been. At laſt a peace was concluded; but then the ratification of it was deferred till Philip had poſſeſſed himſelf of Pheræa in Theſſaly, and ſaw himſelf at the head of a numerous army: then he ratified the treaty; and diſmiſſed the plenipotentiaries with aſſurances, that he would be ready at all times to give the Athenians proofs of his friendſhip. On their return to Athens, when this matter came to be debated before the people, Demoſthenes plainly told them, that, in his opinion, the promiſes of Philip ought not to be relied on, becauſe they appeared to be of little ſignificance in themſelves, and came from a prince of ſo much art, and ſo little fidelity, that they could derive no authority from their maker. Æſchines, on the other hand, gave it as his ſentiment, that the king of Macedon's aſſurances ought to give them full ſatisfaction. He ſaid, that for his part, he was not politician enough to ſee any thing of diſguiſe or diſſimulation in the king's conduct; that there was great danger in diſtruſting princes; and that the ſureſt method of putting men upon deceit was to ſhow that we ſuſpected them of it. The reſt of the plenipotentiaries concurred with Æſchines; and the people, deſirous of quiet, and addicted to pleaſure, eaſily gave credit to all that was ſaid, and decreed that the peace ſhould be kept. All this was the eaſier brought about, becauſe Phocion, the worthieſt man in the republic, did not oppoſe Philip; which was owing to his having a juſt ſenſe of the ſtate his country was in. He conceived, that the Athenians of thoſe times were nothing like their anceſtors; and therefore, as he expreſſed himſelf on another occaſion, he was deſirous, ſince they would not be at the head of Greece themſelves, that they would at leaſt be upon good terms with that power which would be ſo.

57 Paſſes Thermopylæ, and ends the Phocian war.

Philip, who knew how to uſe as well as to procure opportunity, while the Athenians were in this good humour, paſſed Thermopylæ, without their knowing whether he would fall on Phocis or Thebes; but he quickly undeceived them, by commanding his ſoldiers to put on crowns of laurel, declaring them thereby the troops of Apollo, and himſelf the lieutenant-general of that god. He then entered Phocis with an air of triumph; which ſo terrified the Phocians, whom he had cauſed to be proclaimed ſacrilegious perſons, that they immediately diſmiſſed all thoughts of defence, and without more ado ſubmitted to his mercy. Thus the Phocian war, which had ſo long employed all Greece, was ended without a ſtroke; and the judgement on the Phocians remitted to the Amphictyons, or grand council of Greece. By their decree the walls of three Phocian cities were demoliſhed, the people were forbid to inhabit in any but villages, to pay a yearly tribute of 60 talents, and never to make uſe either of houſes or arms till they had repaid to the temple of Apollo the money they had ſacrilegiouſly carried from thence. Their arms were taken from them, broken to pieces, and burnt; their double voice in the council was taken from them, and given to the Macedonians. Other orders were made for ſettling the affairs both of religion and ſtate throughout Greece: all of which were executed by Philip with great exactneſs and moderation, he paying the moſt profound reſpect to the council; and, when he had performed its commands, retiring peaceably with his army back to Macedon, which gained him great reputation. Macedon.

At Athens alone, the juſtice and piety of Philip was not underſtood. The people began to ſee, though a little too late, that they had been abuſed and deceived by thoſe who had negociated the late peace. They ſaw, that, through their acceptance of it, the Phocians were deſtroyed; that Philip was become maſter of Thermopylæ, and might enter Greece when he pleaſed; that, in abandoning their allies, they had abandoned themſelves; and that, in all probability, they might ſoon feel the weight of his power, whom they had ſo fooliſhly truſted: they therefore began to take new and hoſtile meaſures; they ordered that the women ſhould retire out of the villages into the city, their walls be repaired, and their forts new ſtrengthened. They ſeemed inclined to queſtion Philip's election into the council of the Amphictyons, becauſe it had been done without their conſent; and even to proceed to an open war. In all likelihood they had carried things to extravagancy, if Demoſthenes had not interpoſed. He told them, that though he was not for making the peace, he was however for keeping it; and that he ſaw no manner of occaſion for their entering into ſo unequal a conteſt as would needs enſue, if they took up arms, not only againſt Philip, but againſt all the ſtates concurring with him in the late tranſactions. This ſeems to have cooled the rage of the Athenians; and to have brought them to think of *ruining* Philip by degrees, as by degrees they had *raiſed* him.

58 Is again oppoſed by the Athenians.

59 Purſues his conqueſts in Thrace.

The fame of his atchievements without the bounds of Macedon having diſpoſed the ſubjects of Philip to hope every thing from his conduct, and the ſeveral ſtates of Greece to deſire above all things his friendſhip; that prudent monarch laid hold of this favourable ſituation to fix his dominion on ſuch a ſtable foundation as that a reverſe of fortune ſhould not immediately deſtroy it. To this end, while he carried on his negociations through Greece, he likewiſe kept his army in exerciſe, by taking ſeveral places in Thrace, which terribly incommoded the Athenians. Diopithes, who had the government of the Athenian colonies in thoſe parts, perceiving well what end Philip had in view, did not ſtay for inſtructions from home; but having raiſed with much expedition a conſiderable body of troops, taking advantage of the king's being abſent with his army, entered the adjacent territories of Philip, and waſted them with fire and ſword.

60 His dominions invaded by Diopithes.

The king, who, on account of the operations of the cam-

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campaign in the Cherſoneſe, was not at leiſure to repel Diopithes by force, nor indeed could divide his army without imminent hazard, choſe, like an able general, rather to abandon his provinces to inſults, which might be afterwards revenged, than, by following the dictates of an ill-timed paſſion, to hazard the loſs of his veteran army, whereon lay all his hopes. He contented himſelf, therefore, with complaining to the Athenians of Diopithes's conduct, who in a time of peace had entered his dominions, and committed ſuch devaſtations as could ſcarce have been juſtified in a time of war. His partiſans ſupported this application with all their eloquence. They told the Athenians, that unleſs they recalled Diopithes, and brought him to a trial for this infringement of the peace, they ought not to hope either for the friendſhip of Philip or of any other prince or ſtate; neither could they juſtly complain, if, prompted by ſuch a precedent, others ſhould break faith with them, and fall without the leaſt notice upon their dominions. Demoſthenes defended Diopithes; and undertook to ſhow that he deſerved the praiſe and not the cenſure of the Athenians. Thoſe of the other party began then to charge him with crimes of a different nature; they alleged, that he oppreſſed the ſubjects and maltreated the allies of Athens. Demoſthenes replied, that of theſe things there were as yet no proofs; that when ſuch ſhould appear, a ſingle galley might be ſent to bring over Diopithes to abide their judgment, but that Philip would not come if they ſent a fleet; whence he inferred, that they ought to be cautious, and to weigh well the merits of this cauſe before they took any reſolution. He ſaid, that it was true Philip had not as yet attacked Attica, or pretended to make a deſcent on their territories in Greece, or to force his way into their ports; when it came to that, he was of opinion they would be hardly able to defend themſelves; wherefore he thought ſuch men were to be eſteemed as ſought to protect their frontiers, in order to keep Philip as long as might be at a diſtance: whereupon he moved, that, inſtead of diſowning what Diopithes had done, or directing him to diſmiſs his army, they ſhould ſend him over recruits, and ſhow the king of Macedon they knew how to protect their territories, and to maintain the dignity of their ſtate, as well as their anceſtors. Theſe arguments had ſuch an effect, that a decree was made conformable to his motion.

61 Who is defended by Demoſthenes.

While affairs ſtood thus, the Illyrians recovering courage, and ſeeing Philip at ſuch a diſtance, haraſſed the frontiers of Macedon, and threatened a formidable invaſion: but Philip, by quick marches, arrived on the borders of Illyrium; and ſtruck this barbarous people with ſuch a panic, that they were glad to compound for their former depredations at the price he was pleaſed to ſet. Moſt of the Greek cities in Thrace now ſought the friendſhip of the king, and entered into a league with him for their mutual defence. As it cannot be ſuppoſed, that each of theſe free cities had a power equal to that of Philip, we may therefore look upon him as their protector. About this time Philip's negociations in Peloponneſus began to come to light; the Argives and Meſſenians, growing weary of that tyrannical authority which the Spartans exerciſed over them, applied to Thebes for aſſiſtance; and the Thebans, out of their natural averſion to Sparta, ſought

62 Philip's ſchemes defeated.

to open a paſſage for Philip into Peloponneſus, that, in conjunction with them, he might humble the Lacedemonians. Philip readily accepted the offer; and reſolved to procure a decree from the Amphictyons, directing the Lacedemonians to leave Argos and Meſſene free; which if they complied not with, he, as the lieutenant of the Amphictyons, might, with great appearance of juſtice, march with a body of troops to enforce their order. When Sparta had intelligence of this, ſhe immediately applied to Athens, earneſtly intreating aſſiſtance, as in the common cauſe of Greece. The Argives and Meſſenians, on the other hand, laboured aſſiduouſly to gain the Athenians to their ſide; alleging that, if they were friends to liberty, they ought to aſſiſt thoſe whoſe only aim was to be free. Demoſthenes, at this juncture, outwreſtled Philip, if we may borrow that king's expreſſion: for, by a vehement harangue, he not only determined his own citizens to become the avowed enemies of the king, but alſo made the Argives and Meſſenians not over-fond of him for an ally; which when Philip perceived, he laid aſide all thoughts of this enterpriſe for the preſent, and began to practiſe in Eubœa.

This country, now called *Negropont*, is ſeparated from Greece by the Euripus, a ſtrait ſo narrow, that Eubœa might eaſily be united to the continent. This ſituation made Philip call it *the fetters of Greece*, which he therefore ſought to have in his own hands. There had been for ſome years great diſturbances in that country; under colour of which, Philip ſent forces thither, and demoliſhed Porthmos, the ſtrongeſt city in thoſe parts, leaving the country under the government of three lords, whom Demoſthenes roundly calls *tyrants* eſtabliſhed by Philip. Shortly after, the Macedonians took Oreus, which was left under the government of five magiſtrates, ſtyled alſo *tyrants* at Athens. Thither Plutarch of Eretria, one of the moſt eminent perſons in Eubœa, went to repreſent the diſtreſſes of his country, and to implore the Athenians to ſet it free. This ſuit Demoſthenes recommended warmly to the people; who ſent thither their famous leader Phocion, ſupported by formidable votes, but a very ſlender army: yet ſo well did he manage the affairs of the commonwealth and her allies, that Philip quickly found he muſt for a time abandon that project; which, however, he did not till he had formed another no leſs beneficial to himſelf, or leſs dangerous to Athens. It was, the proſecution of his conqueſts in Thrace, which he thought of puſhing much farther than he had hitherto done, or could be reaſonably ſuſpected to have any intention of doing.

Extraordinary preparations were made by the Macedonian monarch for this campaign. His ſon Alexander was left regent of the kingdom; and he himſelf with 30,000 men laid ſiege to Perinthus, one of the ſtrongeſt cities in the country. At preſent, however, all his arts of cajoling and pretending friendſhip were inſufficient to deceive the Athenians. They gave the command of their army and fleet to Phocion; a general of great abilities, and with whom Philip would have found it very hard to contend. On the other hand, the king of Perſia began to turn jealous of the growing power of the Macedonian monarch. The Perſian kings had been accuſtomed to regard thoſe of Macedon as their faithful allies; but the good fortune

of

Macedon. of Philip, the continual clamour of the Athenians againſt him, and his dethroning at pleaſure the petty princes of Thrace, made him now regarded in another light. When therefore he led his troops againſt Perinthus, *the Great King*, as he was ſtyled by the Greeks, ſent his letters mandatory to the governors of the maritime provinces, directing them to ſupply the place with all things in their power; in conſequence of which they filled it with troops, granted ſubſidies in ready money, and ſent beſides great convoys of proviſion and ammunition. The Byzantines alſo, ſuppoſing their own turn would be next, exerted their utmoſt endeavours for the preſervation of Perinthus; ſending thither the flower of their youth, with all other neceſſaries for an obſtinate defence. The conſequence of all this was, that Philip found himſelf obliged to raiſe the ſiege with great loſs.

63 How he at laſt gained his point.

That the reputation of the Macedonian arms might not ſink by this diſgrace, Philip made war on the Scythians and Triballi, both of whom he defeated; and then formed a deſign of invading Attica, though he had no fleet to tranſport his troops, and knew very well that the Theſſalians were not to be depended upon if he attempted to march through the Piſæ, and that the Thebans would even then be ready to oppoſe his march. To obviate all theſe difficulties, he had recourſe to Athens itſelf; where, by means of his partiſans, he procured his old friend Æſchines to be ſent their deputy to the Amphictyons. This ſeemed a ſmall matter, and yet was the hinge on which his whole project turned. By that time Æſchines had taken his ſeat, a queſtion was ſtirred in the council, whether the Locrians of Amphiſia had not been guilty of ſacrilege in ploughing the fields of Cyrrha in the neighbourhood of the temple of Delphi. The aſſembly being divided in their opinions, Æſchines propoſed to take a view; which was accordingly decreed. But when the Amphictyons came in order to ſee how things ſtood, the Locrians, either jealous of their property, or ſpurred thereto by the ſuggeſtions of ſome who ſaw farther than themſelves, fell upon thoſe venerable perſons ſo rudely, that they were compelled to ſecure themſelves by flight. The Amphictyons decreed, that an army ſhould be raiſed, under the command of one of their own number, to chaſtiſe the delinquents; but as this army was to be compoſed of troops ſent from all parts of Greece, the appearance at the rendezvous was ſo inconſiderable, that the Amphictyons ſent to command them durſt undertake nothing. The whole matter being reported to the council, Æſchines, in a long and eloquent harangue, ſhowed how much the welfare and even the ſafety of Greece depended on the deference paid to their decrees; and after inveighing againſt the want of public ſpirit in ſuch as had not ſent their quotas at the time appointed by the council, he moved that they ſhould elect Philip for their general, and pray him to execute their decree. The deputies from the other ſtates, conceiving that by this expedient their reſpective conſtituents would be free from any farther trouble or expence, came into it at once; whereupon a decree was immediately drawn up, purporting that ambaſſadors ſhould be ſent to Philip of Macedon, in the name of Apollo and the Amphictyons, once more to require his aſſiſtance, and to notify to him, that the ſtates of Greece had unanimouſly choſen him their general, with full power to act as he thought fit againſt ſuch as had oppoſed the authority of the Amphictyons. Thus of a ſudden Philip acquired all that he ſought; and having an army ready in expectation of this event, he immediately marched to execute the commands of the Amphictyons in appearance, but in reality to accompliſh his own deſigns. For having paſſed into Greece with his army, inſtead of attacking the Locrians, he ſeized immediately upon Elatea a great city of Phocis upon the river Cephiſus. Macedon.

64 Is choſen general by the Amphictyons.

65 Is oppoſed by the Athenians and Thebans.

The Athenians in the mean time were in the utmoſt confuſion on the news of Philip's march. However, by the advice of Demoſthenes, they invited the Thebans to join them againſt the common enemy of Greece. Philip endeavoured as much as poſſible to prevent this confederacy from taking place; but all his efforts proved ineffectual. The Athenians raiſed an army, which marched immediately to Eleuſis, where they were joined by the Thebans. The confederates made the beſt appearance that had ever been ſeen in Greece, and the troops were exceedingly good; but unfortunately the generals were men of no conduct or ſkill in the military art. An engagement enſued at Cheronæa; wherein Alexander commanded one wing of the Macedonian army, and his father Philip the other. The confederate army was divided according to the different nations of which it conſiſted; the Athenians having the right and the Bœotians the left. In the beginning of the battle the confederates had the better; whereupon Stratocles an Athenian commander cried out, "Come on, brother ſoldiers, let us drive them back to Macedon:" which being overheard by the king, he ſaid very coolly to one of his officers, "Theſe Athenians do not know how to conquer." Upon this he directed the files of the phalanx to be ſtraitened; and drawing his men up very cloſe, retired to a neighbouring eminence: from whence, when the Athenians were eager in their purſuit, he ruſhed down with impetuoſity, broke, and routed them with prodigious ſlaughter. The orator Demoſthenes behaved very unbecomingly in this engagement; for he deſerted his poſt, and was one of the firſt that fled: nay, we are told, that a ſtake catching hold of his robe, he, not doubting but it was an enemy, cried out, "Alas! ſpare my life."

66 Whom he defeats at Cheronæa.

This victory determined the fate of Greece; and from this time we muſt reckon Philip ſupreme lord of all the Grecian ſtates. The firſt uſe he made of his power was to convoke a general aſſembly, wherein he was recogniſed generaliſſimo, and with full power appointed their leader againſt the Perſians. Having, by virtue of his authority, ſettled a general peace among them, and appointed the quota that each of the ſtates ſhould furniſh for the war, he diſmiſſed them; and returning to Macedon, began to make great preparations for this new expedition. His pretence for making war on the Perſians at this time was the aſſiſtance given by the Perſians to the city of Perinthus, as already mentioned. In the mean time, however, the king, by reaſon of the diſſenſions which reigned in his family, was made quite miſerable. He quarrelled with his wife Olympias to ſuch a degree, that he divorced her, and married another woman named *Cleopatra*. This produced a quarrel between him and his ſon Alexander;

67 Is appointed general againſt the Perſians.

Macedon. lexander; which alſo came to ſuch an height, that Alexander retired into Epirus with his mother. Some time afterwards, however, he was recalled, and a reconciliation took place in appearance; but in the mean time a conſpiracy was formed againſt the king's life, the circumſtances and cauſes of which are very much unknown. Certain it is, however, that it took effect, as the king was exhibiting certain ſhows in honour of his daughter's marriage with the king of Epirus. Philip, having given a public audience to the ambaſſadors of Greece, went next day in ſtate to the theatre. All the ſeats were early taken up; and the ſhows began with a ſplendid proceſſion, wherein the images of the 12 ſuperior deities of Greece were carried, as alſo the image of Philip, habited in like manner, as if he now made the 13th, at which the people ſhouted aloud. Then came the king alone, in a white robe, crowned, with his guards at a conſiderable diſtance, that the Greeks might ſee he placed his ſafety only in his confidence of the loyalty of his ſubjects. Pauſanias, the aſſaſſin, however, had fixed himſelf cloſe by the door of the theatre; and obſerving that all things fell out as he had foreſeen they would, took his opportunity when the king drew near him, and plunging his ſword in his left ſide, laid him dead at his feet. He then fled as faſt as he was able towards the place where his horſes were; and would have eſcaped, had not the twig of a vine catched his ſhoe and thrown him down. This gave time to thoſe who purſued him to come up with him; but inſtead of ſecuring him, in order to extort a diſcovery of his accomplices, they put an end to his life.

68 Is murdered.

69 His character.

With regard to the character of this monarch, it appears certain, that he was one of the moſt eminent perſons that ever ſat on a throne. Had he lived for ſome time longer, he would in all probability have ſubdued the Perſians; which was in truth leſs difficult than what he had already done. "Had that event taken place (ſays Dr Gillies), the undertakings of his long and ſucceſsful reign would have been ennobled and illuminated by the ſplendor of extenſive foreign conqueſt. Philip would have reached the height of ſuch renown as is obtained by the habits of activity, vigilance, and fortitude, in the purſuit of unbounded greatneſs; and in the opinion of poſterity, would perhaps have ſurpaſſed the glory of all kings and conquerors who either preceded or followed him. Yet, even on this ſuppoſition, there is not any man of ſenſe and probity, who, if he allows himſelf time for ſerious reflection, would purchaſe the imagined grandeur and proſperity of the king of Macedon at the price of his artifices and his crimes; and to a philoſopher, who conſidered either the means by which he had obtained his triumphs or the probable conſequences of his dominion over Greece and Aſia, the buſy ambition of this mighty conqueror would appear but a deceitful ſcene of ſplendid miſery."

70 Extravagant joy of the Athenians.

No ſooner did the news of Philip's death reach Athens, than, as if all danger had been paſt, the inhabitants ſhowed the moſt extravagant ſigns of joy. Demoſthenes and his party put on chaplets of flowers, and behaved as if they had gained a great victory. Phocion reproved them for this madneſs; bidding them remember, that "the army which had beaten them at Cheronæa was leſſened but by one." This reproof, however, had very little effect. The people heard with pleaſure all the harſh things which the orators could ſay of the young Alexander king of Macedon, whom they repreſented as a giddy wrong-headed boy, ready to graſp all things in his imagination, and able to perform nothing. The affairs of Macedon indeed were in a very diſtracted ſtate on the acceſſion of Alexander: for all the neighbouring nations had the ſame notion of the young king with the Athenians; and being irritated by the uſurpations of Philip, immediately revolted; and the ſtates of Greece entered into a confederacy againſt him. The Perſians had been contriving to transfer the war into Macedon; but as ſoon as the news of Philip's death reached them, they behaved as if all danger had been over. At the ſame time Attalus, one of the Macedonian commanders, aſpired to the crown, and ſought to draw off the ſoldiers from their allegiance. Macedon.

In the councils held on this occaſion, Alexander's beſt friends adviſed him rather to make uſe of diſſimulation than force, and to cajole thoſe whom they thought he could not ſubdue. Theſe advices, however, were ill-ſuited to the temper of their monarch. He thought that vigorous meaſures only were proper; and therefore immediately led his army into Theſſaly. Here he harangued the princes ſo effectually, that he thoroughly gained them over to his intereſt, and was by them declared general of Greece; upon which he returned to Macedon, where he cauſed Attalus to be ſeized and put to death.

71 Alexander declared general of Greece.

In the ſpring of the next year (335 B. C.) Alexander reſolved to ſubdue the Triballians and Illyrians, who inhabited the countries now called *Bulgaria* and *Sclavonia*, and had been very formidable enemies to the Macedonian power. In this expedition he diſcovered, though then but 20 years of age, a ſurpriſing degree of military knowledge. Having advanced to the paſſes of Mount Hæmus, he found that the barbarians had poſted themſelves in the moſt advantageous manner. On the tops of the cliffs, and at the head of every paſſage, they had placed their carriages and waggons in ſuch a manner as to form a kind of parapet with their ſhafts inwards, that when the Macedonians ſhould have half aſcended the rock, they might be able to puſh theſe heavy carriages down upon them. They reckoned the more upon this contrivance, becauſe of the cloſe order of the phalanx, which, they imagined, would be terribly expoſed by the ſoldiers wanting room to ſtir, and thereby avoid the falling waggons. But Alexander, having directed his heavy-armed troops to march, gave orders, that, where the way would permit, they ſhould open to the right and left, and ſuffer the carriages to go through; but that, in the narrow paſſes, they ſhould throw themſelves on their faces with their ſhields behind them, that the carts might run over them. This had the deſired effect; and the Macedonians reached the enemies works without the loſs of a man. The diſpute was then quickly decided; the barbarians were driven from their poſts with great ſlaughter, and left behind them a conſiderable booty for the conquerors.

72 Defeats the Triballi.

The next exploits of Alexander were againſt the Getæ, the Tanlantii, and ſome other nations inhabiting the country on the other ſide of the Danube. Them he alſo overcame; ſhowing in all his actions

the

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the moſt perfect ſkill in military affairs, joined with the greateſt valour. In the mean time, however, all Greece was in commotion by a report which had been confidently ſpread abroad, that the king was dead in Illyria. The Thebans, on this news, ſeized Amyntas and Timolaus, two eminent officers in the Macedonian garriſon which held their citadel, and dragged them to the market-place, where they were put to death without either form or proceſs, or any crime alleged againſt them. Alexander, however, did not ſuffer them to remain long in their miſtake. He marched with ſuch expedition, that in ſeven days he reached Pallene in Theſſaly; and in ſix days more he entered Bœotia, before the Thebans had any intelligence of his paſſing the ſtraits of Thermopylæ. Even then they would not believe that the king was alive; but inſiſted that the Macedonian army was commanded by Antipater, or by one Alexander the ſon of Æropus. The reſt of the Greeks, however, were not ſo hard of belief; and therefore ſent no aſſiſtance to the Thebans, who were thus obliged to bear the conſequences of their own folly and obſtinacy. The city was taken by ſtorm, and the inhabitants were for ſome hours maſſacred without diſtinction of age or ſex; after which the houſes were demoliſhed, all except that of Pindar the famous poet, which was ſpared out of reſpect to the merit of its owner, and becauſe he had celebrated Alexander I. king of Macedon. The lands, excepting thoſe deſtined to religious uſes, were ſhared among the ſoldiers, and all the priſoners ſold for ſlaves; by which 440 talents were brought into the king's treaſury.

73 The Thebans revolt on the news of his death.

74 Thebes taken and deſtroyed.

By this ſeverity the reſt of the Grecian ſtates were ſo thoroughly humbled, that they thought no more of making any reſiſtance, and Alexander had nothing further to hinder him from his favourite project of invading Aſia. Very little preparation was neceſſary for the Macedonian monarch, who went out as to an aſſured conqueſt, and reckoned upon being ſupplied only by the ſpoils of his enemies. Hiſtorians are not agreed as to the number of his army: Arrian ſays, that there were 30,000 foot and 5000 horſe. Diodorus Siculus tells us, that there were 13,000 Macedonian foot, 7000 of the confederate ſtates, and 5000 mercenaries. Theſe were under the command of Parmenio. Of the Odriſians, Triballians, and Illyrians, there were 5000; and of the Agrians, who were armed only with darts, 1000. As for the horſe, he tells us there were 18,000 commanded by Philotas, and as many Theſſalians under the command of Callas: out of the confederate ſtates of Greece, were 600 commanded by Eurygius; and 900 Thracians and Peonians, who led the van under Caſſander. Plutarch tells us, that, according to a low computation, he had 30,000 foot and 5000 horſe; and, according to the largeſt reckoning, he had 34,000 foot and 4000 horſe. As to his fund for the payment of the army, Ariſtobulus ſays it was but 70 talents; and Oneſicritus, who was alſo in this expedition, not only takes away the 70 talents, but affirms that the king was 200 in debt. As for proviſions, there was juſt ſufficient for a month and no more; and to prevent diſturbances, Antipater was left in Macedon with 12,000 foot and 1500 horſe.

75 Number of the army with which he invaded Aſia.

76 Sets out on his expedition.

The army having aſſembled at Amphipolis, he marched from thence to the mouths of the river Strymon; then croſſing mount Pangæus, he took the road to Abdera. Croſſing the river Ebrus, he proceeded through the country of Pætis, and in 20 days reached Seſtos; thence he came to Eleus, where he ſacrificed on the tomb of Proteſilaus, becauſe he was the firſt among the Greeks who at the ſiege of Troy ſet foot on the Aſiatic ſhore. He did this, that his landing might be more propitious than that of the hero to whom he ſacrificed, who was ſlain ſoon after. The greateſt part of the army, under the command of Parmenio, embarked at Seſtos, on board a fleet of 160 galleys of three benches of oars, beſides ſmall craft. Alexander himſelf ſailed from Eleus; and when he was in the middle of the Helleſpont, offered a bull to Neptune and the Nereids, pouring forth at the ſame time a libation from a golden cup. When he drew near the ſhore, he lanched a javelin, which ſtuck in the earth: then, in complete armour, he leaped upon the ſtrand; and having erected altars to Jupiter, Minerva, and Hercules, he proceeded to Ilium. Here again he ſacrificed to Minerva; and taking down ſome arms which had hung in the temple of that goddeſs ſince the time of the Trojan war, conſecrated his own in their ſtead. He ſacrificed alſo to the ghoſt of Priam, to avert his wrath on account of the deſcent which he himſelf claimed from Achilles.

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In the mean time the Perſians had aſſembled a great army in Phrygia; among whom was one Memnon a Rhodian, the beſt officer in the ſervice of Darius. Alexander, as ſoon as he had performed all the ceremonies which he judged neceſſary, marched directly towards the enemy. Memnon gave it as his opinion, that they ſhould burn and deſtroy all the country round, that they might deprive the Greeks of the means of ſubſiſting, and then tranſport a part of their army into Macedon. But the Perſians, depending on their cavalry, rejected this ſalutary advice; and poſted themſelves along the river Granicus, in order to wait the arrival of Alexander. In the engagement which happened on the banks of that river, the Perſians were defeated†, and Alexander became maſter of all the neighbouring country; which he immediately began to take care of, as if it had been part of his hereditary dominions. The city of Sardis was immediately delivered up; and here Alexander built a temple to Jupiter Olympius. After this, he reſtored the Epheſians to their liberty; ordered the tribute which they formerly paid to the Perſians to be applied towards the rebuilding of the magnificent temple of Diana; and having ſettled the affairs of the city, marched againſt Miletus. This place was defended by Memnon with a conſiderable body of troops who had fled thither after the battle of Granicus, and therefore made a vigorous reſiſtance. The fortune of Alexander, however, prevailed; and the city was ſoon reduced, though Memnon with part of the troops eſcaped to Halicarnaſſus. After this, the king diſmiſſed his fleet, for which various reaſons have been aſſigned; though it is probable, that the chief one was to ſhow his army that their only reſource now was in ſubverting the Perſian empire.

† See Granicus.

77 Conſequences of his firſt victory.

Almoſt all the cities between Miletus and Halicarnaſſus ſubmitted as ſoon as they heard that the former was taken; but Halicarnaſſus, where Memnon commanded with a very numerous garriſon, made an obſtinate defence. Nothing, however, was able to reſiſt the

Macedon. the Macedonian army. Memnon was at laſt obliged to abandon the place; upon which Alexander took and raſed the city of Tralles in Phrygia; received the ſubmiſſion of ſeveral princes tributary to the Perſians; and having deſtroyed the Marmarians, a people of Lycia who had fallen upon the rear of his army, put an end to the campaign; after which he ſent home all the new-married men; in obedience, it would ſeem, to a precept of the Moſaic law, and which endeared him more to his ſoldiers than any other action of his life.

As ſoon as the ſeaſon would permit, Alexander quitted the province of Phaſelus; and having ſent part of his army through the mountainous country to Perga, by a ſhort but difficult road, took his route by a certain promontory, where the way is altogether impaſſable, except when the north winds blow. At the time of the king's march the ſouth wind had held for a long time; but of a ſudden it changed, and blew from the north ſo violently, that, as he and his followers declared, they obtained a ſafe and eaſy paſſage through the Divine aſſiſtance. By many this march is held to be miraculous, and compared to that of the children of Iſrael through the Red Sea; while, on the other hand, it is the opinion of others, that there was nothing at all extraordinary in it. He continued his march towards Gordium, a city of Phrygia; the enemy having abandoned the ſtrong paſs of Telmiſſus, through which it was neceſſary for him to march. When he arrived at Gordium, and found himſelf under a neceſſity of ſtaying ſome time there till the ſeveral corps of his army could be united, he expreſſed a ſtrong deſire of ſeeing Gordius's chariot, and the famous knot in the harneſs, of which ſuch ſtrange ſtories had been publiſhed to the world. The cord in which this knot was tied, was made of the inner rind of the cornel-tree; and no eye could perceive where it had begun or ended. Alexander, when he could find no poſſible way of untying it, and yet was unwilling to leave it tied leſt it ſhould cauſe ſome fears in the breaſts of his ſoldiers, is ſaid by ſome authors to have cut the cords with his ſword, ſaying, "It matters not how it is undone." But Ariſtobulus aſſures us, that the king wreſted a wooden pin out of the beam of the waggon, which, being driven in acroſs the beam, held it up; and ſo took the yoke from under it. Be this as it will, however, Arrian informs us, that a great tempeſt of thunder, lightning, and rain, happening the ſucceeding night, it was held declarative of the true ſolution of this knot, and that Alexander ſhould become lord of Aſia.

78 Unties the Gordian knot.

The king having left Gordium, marched towards Cilicia; where he was attended with his uſual good fortune, the Perſians abandoning all the ſtrong paſſes as he advanced. As ſoon as he entered the province, he received advice that Arſames, whom Darius had made governor of Tarſus, was about to abandon it, and that the inhabitants were very apprehenſive that he intended to plunder them before he withdrew. To prevent this, the king marched inceſſantly, and arrived juſt in time to ſave the city. But his ſaving it had well nigh coſt him his life: for, either through the exceſſive fatigue of marching, as ſome ſay, or, according to others, by his plunging when very hot into the river Cydnus, which, as it runs through thick ſhades, has its waters exceſſively cold, he fell into ſuch a diſtemper as threatened his immediate diſſolution. His army loſt their ſpirits immediately; the generals knew not what to do; and his phyſicians were ſo much affrighted, that the terror of his death hindered them from uſing the neceſſary methods for preſerving his life. Philip the Acarnanian alone preſerved temper enough to examine the nature of the king's diſeaſe; the worſt ſymptom of which was a continual waking, and which he took off by means of a potion, and in a ſhort time the king recovered his uſual health. Macedon.

79 His ſickneſs and recovery.

Soon after Alexander's recovery, he received the agreeable news that Ptolemy and Aſander had defeated the Perſian generals, and made great conqueſts on the Helleſpont; a little after that, he met the Perſian army at Iſſus, commanded by Darius himſelf. A bloody engagement enſued, in which the Perſians were defeated with great ſlaughter, as related under the article Issus. The conſequences of this victory were very advantageous to the Macedonians. Many governors of provinces and petty princes ſubmitted themſelves to the conqueror; and ſuch as did ſo were treated, not as a newly-conquered people, but as his old hereditary ſubjects; being neither burthened with ſoldiers nor oppreſſed with tribute. Among the number of thoſe places which, within a ſhort ſpace after the battle of Iſſus, ſent deputies to ſubmit to the conqueror, was the city of Tyre. The king, whoſe name was Azelmicus, was abſent in the Perſian fleet; but his ſon was among the deputies, and was very favourably received by Alexander. The king probably intended to confer particular honours on the city of Tyre; for he acquainted the inhabitants that he would come and ſacrifice to the Tyrian Hercules, the patron of their city, to whom they had erected a moſt magnificent temple. But theſe people, like moſt other trading nations, were too ſuſpicious to think of admitting ſuch an enterpriſing prince with his troops within their walls. They ſent therefore their deputies again to him, to inform him, that they were ready to do whatever he ſhould command them; but, as to his coming and ſacrificing in their city, they could not conſent to that, but were poſitively determined not to admit a ſingle Macedonian within their gates. Alexander immediately diſmiſſed their deputies in great diſpleaſure. He then aſſembled a council of war, wherein he inſiſted ſtrongly on the diſaffected ſtate of Greece, (for moſt of the Grecian ſtates had ſent ambaſſadors to Darius, to enter into a league with him againſt the Macedonians), the power of the Perſians by ſea, and the folly of carrying on the war in diſtant provinces, while Tyre was left unreduced behind them: he alſo remarked, that if once this city was ſubdued, the ſovereignty of the ſea would be transferred to them, becauſe it would fix their poſſeſſion of the coaſts; and as the Perſian fleet was compoſed chiefly of tributary ſquadrons, thoſe tributaries would fight the battles, not of their late but of their preſent maſters. For theſe reaſons the ſiege of Tyre was reſolved on. The town was not taken, however, without great difficulty; which provoked Alexander to ſuch a degree, that he treated the inhabitants with the greateſt cruelty. See Tyre.

80 Tyre taken and deſtroyed.

After the reduction of Tyre, Alexander, though the ſeaſon was already far advanced, reſolved to make

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Macedon. an expedition into Syria; and in his way thither propoſed to chaſtiſe the Jews, who had highly offended him during the ſiege of Tyre: for when he ſent to them to demand proviſions for his ſoldiers, they anſwered, That they were the ſubjects of Darius, and bound by oath not to ſupply his enemies. The king, however, was pacified by their ſubmiſſion; and not only pardoned them, but conferred many privileges upon them, as related under the article JEWS.

81 Egypt ſubmits. From Jeruſalem Alexander marched directly to Gaza, the only place in that part of the world which ſtill held out for Darius. This was a very large and ſtrong city, ſituated on an high hill, about five miles from the ſea-ſhore. One *Batis*, or *Betis*, an eunuch, had the government of the place; and had made every preparation neceſſary for ſuſtaining a long and obſtinate ſiege. The governor defended the place with great valour, and ſeveral times repulſed his enemies: but at laſt it was taken by ſtorm, and all the garriſon ſlain to a man; and this ſecured to Alexander an entrance into Egypt, which having before been very impatient of the Perſian yoke, admitted the Macedonians peaceably.

82 Alexander viſits the temple of Jupiter Ammon. Here the king laid the foundations of the city of Alexandria, which for many years after continued to be the capital of the country. While he remained here, he alſo formed the extraordinary deſign of viſiting the temple of Jupiter Ammon. As to the motives by which he was induced to take this extraordinary journey, authors are not agreed; but certain it is, that he hazarded himſelf and his troops in the higheſt degree; there being two dangers in this march, which, with the example of Cambyſes, who loſt the greateſt part of his army in it, might have terrified any body but Alexander. The firſt was the want of water, which, in the ſandy deſarts ſurrounding the temple, is no where to be found; the other, the uncertainty of the road from the fluctuation of the ſands; which changing their ſituation every moment, leave the traveller neither a road to walk in nor mark to march by. Theſe difficulties, however, Alexander got over; though not without a miraculous interpoſition, as is pretended by all his hiſtorians.

Alexander having conſulted the oracle, and received a favourable anſwer, returned to purſue his conqueſts. Having ſettled the government of Egypt, he appointed the general rendezvous of his forces at Tyre. Here he met with ambaſſadors from Athens, requeſting him to pardon ſuch of their countrymen as he found ſerving the enemy. The king, being deſirous to oblige ſuch a famous ſtate, granted their requeſt; and ſent alſo a fleet to the coaſt of Greece, to prevent the effects of ſome commotions which had lately happened in Peloponneſus. He then directed his march to Thapſacus; and having paſſed the Euphrates and Tigris, met with Darius near Arbela, where the Perſians were again overthrown with prodigious ſlaughter†, and Alexander in effect became maſter of the Perſian empire.

† See *Arbela*.

83 Reduces Babylon, Suſa, and Perſepolis. After this important victory, Alexander marched directly to Babylon, which was immediately delivered up; the inhabitants being greatly diſaffected to the Perſian intereſt. After 30 days ſtay in this country, the king marched to Suſa, which had already ſurrendered to Philoxenus; and here he received the treaſures of the Perſian monarch, amounting, according to the moſt generally received account, to 50,000 talents. Having received alſo at this time a ſupply of 6000 foot and 500 horſe from Macedon, he ſet about reducing the nations of Media, among whom Darius was retired. He firſt reduced the Uxians: and having forced a paſſage to Perſepolis the capital of the empire, he like a barbarian deſtroyed the ſtately palace there, a pile of building not to be equalled in any part of the world; after having given up the city to be plundered by his ſoldiers. In the palace he found 120,000 talents, which he appropriated to his own uſe, and cauſed immediately to be carried away upon mules and camels; for he had ſuch an extreme averſion to the inhabitants of Perſepolis, that he determined to leave nothing valuable in the city. Macedon.

During the time that Alexander remained at Perſepolis, he received intelligence that Darius remained at Ecbatana the capital of Media; upon which he purſued him with the greateſt expedition, marching at the rate of near 40 miles a-day. In 15 days he reached Ecbatana, where he was informed that Darius had retired from thence five days before, with an intent to paſs into the remoteſt provinces of his empire. This put ſome ſtop to the rapid progreſs of the Macedonian army; and the king perceiving that there was no neceſſity for hurrying himſelf and his ſoldiers in ſuch a manner, began to give the orders requiſite in the preſent ſituation of his affairs. The Theſſalian horſe, who had deſerved exceedingly well of him in all his battles, he diſmiſſed according to his agreement; gave them their whole pay, and ordered 2000 talents over and above to be diſtributed among them. He then declared that he would force no man: but if any were willing to ſerve him longer for pay, he deſired they would enter their names in a book, which a great many of them did; the reſt ſold their horſes, and prepared for their departure. The king appointed Epocillus to conduct them to the ſea, and aſſigned him a body of horſe as an eſcort: he likewiſe ſent Menetes with them, to take care of their embarkation, and that they were ſafely landed in Eubœa without any expence to themſelves. 84 He purſues Darius.

On receiving freſh information concerning the ſtate of Darius's affairs, the king ſet out again in purſuit of him, advancing as far as Rhages, a city one day's journey from the Caſpian ſtraits: there he underſtood that Darius had paſſed thoſe ſtraits ſome time before; which information leaving him again without hopes, he halted for five days. Oxidates, a Perſian whom Darius had left priſoner at Suſa, was made governor of Media, while the king departed on an expedition into Parthia. The Caſpian ſtraits he paſſed immediately without oppoſition; and then gave directions to his officers to collect a quantity of proviſions ſufficient to ſerve his army on a long march through a waſted country. But before his officers could accompliſh thoſe commands, the king received intelligence that Darius had been murdered by Beſſus, one of his own ſubjects, and governor of Bactria, as is related at length under the article PERSIA. 85 Who is murdered.

86 Alexander reduces Hyrcania. As ſoon as Alexander had collected his forces together, and ſettled the government of Parthia, he entered Hyrcania; and having, according to his uſual cuſtom, committed the greateſt part of his army to the care of Craterus, he, at the head of a choice body of troops, paſſed through certain craggy roads,

Macedon. and before the arrival of Craterus, who took an open and eaſy path, ſtruck the whole provinces with ſuch terror, that all the principal places were immediately put into his hands, and ſoon after the province of Aria alſo ſubmitted, and the king continued Satibarzanes the governor in his employment.—The reduction of this province finiſhed the conqueſt of Perſia; but the ambition of Alexander to become maſter of every nation of which he had the leaſt intelligence, induced him to enter the country of the *Mardi*, merely becauſe its rocks and barrenneſs had hitherto hindered any body from conquering, or indeed from attempting to conquer it. This conqueſt, however, he eaſily accompliſhed, and obliged the whole nation to ſubmit to his pleaſure. But in the mean time diſturbances began to ariſe in Alexander's new empire, and among his troops, which all his activity could not thoroughly ſuppreſs. He had ſcarcely left the province of Aria, when he received intelligence, that the traitor Beſſus had cauſed himſelf to be proclaimed king of Aſia by the name of *Artaxerxes*; and that Satibarzanes had joined him, after having maſſacred all the Macedonians who had been left in the province. Alexander appointed one *Arſames* governor in the room of Satibarzanes; and marched thence with his army againſt the *Zarangæ*, who under the command of Barzaentes, one of thoſe who had conſpired againſt Darius, had taken up arms, and threatened to make an obſtinate defence. But their numbers daily falling off, Barzaentes being afraid they would purchaſe their own ſafety at the expence of his, privately withdrew from his camp, and, croſſing the river Indus, ſought ſhelter among the nations beyond it. But they, either dreading the power of Alexander, or deteſting the treachery of this Perſian towards his former maſter, ſeized and delivered him up to Alexander, who cauſed him immediately to be put to death.

87 The Macedonians give themſelves up to luxury.

The immenſe treaſure which the Macedonians had acquired in the conqueſt of Perſia began now to corrupt them. The king himſelf was of a moſt generous diſpoſition, and liberally beſtowed his gifts on thoſe around him; but they made a bad uſe of his bounty, and fooliſhly indulged in thoſe vices by which the former poſſeſſors of that wealth had loſt it. The king did all in his power to diſcourage the lazy and inactive pride which now began to ſhow itſelf among his officers; but neither his diſcourſes nor his example had any conſiderable effect. The manners of his courtiers from bad became worſe, in ſpite of all he could ſay or do to prevent it; and at laſt they proceeded to cenſure his conduct, and to expreſs themſelves with ſome bitterneſs on the ſubject of his long continuance of the war, and his leading them conſtantly from one labour to another. This came to ſuch an height, that the king was at laſt obliged to uſe ſome ſeverity in order to keep his army within the limits of their duty.

88 Alexander conforms to the Perſian cuſtoms.

From this time forward, however, Alexander himſelf began to alter his conduct; and by giving a little into the cuſtoms of the Orientals, endeavoured to ſecure that obedience from his new ſubjects which he found ſo difficult to be preſerved among his old ones. He likewiſe endeavoured, by various methods, to blend the cuſtoms of the Aſiatics and the Greeks. The form of his civil government reſembled that of the ancient Perſian kings: in the military affairs, however, he preſerved the Macedonian diſcipline; but Macedon. then he made choice of 30,000 boys out of the provinces, whom he cauſed to be inſtructed in the Greek language, and directed to be brought up in ſuch a manner as that from time to time he might with them fill up the phalanx. The Macedonians ſaw with great concern theſe extraordinary meaſures, which ſuited very ill with their groſs underſtandings; for they thought, after all the victories they had gained, to be abſolute lords of Aſia, and to poſſeſs not only the riches of its inhabitants, but to rule the inhabitants themſelves: whereas they now ſaw, that Alexander meant no ſuch thing; but that, on the contrary, he conferred governments, offices at court, and all other marks of confidence and favour, indiſcriminately both on Greeks and Perſians.—From this time alſo the king ſeems to have given inſtances of a cruelty he had never ſhown before. Philotas his moſt intimate friend was ſeized, tortured, and put to death for a conſpiracy of which it could never be proved that he was guilty; and ſoon after Parmenio and ſome others were executed without any crime at all real or alleged. Theſe things very much diſturbed the army. Some of them wrote home to Macedonia of the king's ſuſpicions of his friends, and his diſpoſition to hunt out enemies at the very extremities of the world. Alexander having intercepted ſome of theſe letters, and procured the beſt information he could concerning their authors, picked out theſe diſſatisfied people, and having diſpoſed them into one corps, gave it the title of the *turbulent battalion*; hoping by this means to prevent the ſpirit of diſaffection from pervading the whole army.

As a farther precaution againſt any future conſpiracy, Alexander thought fit to appoint Hephæſtion and Clytus generals of the auxiliary horſe; being apprehenſive, that if this authority was lodged in the hands of a ſingle perſon, it might prompt him to dangerous undertakings, and at the ſame time furniſh him with the means of carrying them into execution. To keep his forces in action, he ſuddenly marched into the country of the Euergetæ, i. e. *Benefactors*; and found them full of that kind and hoſpitable diſpoſition for which that name had been beſtowed on their anceſtors: he therefore treated them with great reſpect; and at his departure added ſome lands to their dominions, which lay contiguous, and which for that reaſon they had requeſted of him.

Turning then to the eaſt, he entered Arachoſia, the inhabitants of which ſubmitted without giving him any trouble. While he paſſed the winter in theſe parts, the king received advice, that the Arians, whom he had ſo lately ſubdued, were again up in arms, Satibarzanes being returned into that country with two thouſand horſe aſſigned him by Beſſus. Alexander inſtantly diſpatched Artabazus the Perſian, with Erigyus and Caranus, two of his commanders, with a conſiderable body of horſe and foot: he likewiſe ordered Phrataphernes, to whom he had given the government of Parthia, to accompany them. A general engagement enſued, wherein the Arians behaved very well, as long as their commander Satibarzanes lived; but he engaging Erigyus, the Macedonian ſtruck him firſt into the throat, and then, drawing forth his ſpear again, through the mouth; ſo that he immediately

89 Satibarzanes defeated and killed.

Macedon. mediately expired, and with him the courage of his soldiers, who instantly began to fly; whereupon Alexander's commanders made an easy conquest of the rest of the country, and settled it effectually under his obedience.

The king, notwithstanding the inclemency of the season, advanced into the country of Paropamisus, so called from the mountain Paropamisus, which the soldiers of Alexander called *Caucasus*. Having crossed the country in 16 days, he came at length to an opening leading into Media; which finding of a sufficient breadth, he directed a city to be built there, which he called *Alexandria*, as also several other towns about a day's journey distant from thence: and in these places he left 7000 persons, part of them such as had hitherto followed his camp, and part of the mercenary soldiers, who, weary of continual fatigue, were content to dwell there. Having thus settled things in this province, sacrificed solemnly to the gods, and appointed Proexes the Persian president thereof, with a small body of troops under the command of Niloxenus to assist him, he resumed his former design of penetrating into Bactria.

90 Bessus reduced and put to death.

Bessus, who had assumed the title of *Artaxerxes*, when he was assured that Alexander was marching towards him, immediately began to waste all the country between Paropamisus and the river Oxus; which river he passed with his forces, and then burnt all the vessels he had made use of for transporting them, retiring to Nautaca, a city of Sogdia; fully persuaded, that, by the precautions he had taken, Alexander would be compelled to give over his pursuit. This conduct of his, however, disheartened his troops, and gave the lie to all his pretensions; for he had affected to censure Darius's conduct, and had charged him with cowardice, in not defending the rivers Euphrates and Tigris, whereas he now quitted the banks of the most defensible river perhaps in the whole world. As to his hopes, tho' it cannot be said they were ill founded, yet they proved absolutely vain; for Alexander, continuing his march, notwithstanding all the hardships his soldiers sustained, reduced all Bactria under his obedience, particularly the capital Bactria and the strong castle Aornus: in the latter he placed a garrison under the command of Archelaus; but the government of the province he committed to Artabazus. He then continued his march to the river Oxus: on the banks of which when he arrived, he found it three quarters of a mile over, its depth more than proportionable to its breadth, its bottom sandy, its stream so rapid as to render it almost unnavigable, and neither boat nor tree in its neighbourhood; so that the ablest commanders in the Macedonian army were of opinion that they should be obliged to march back. The king, however, having first sent away, under a proper escort, all his infirm and worn-out soldiers, that they might be conducted safe to the sea-ports, and from thence to Greece, devised a method of passing this river without either boat or bridge, by causing the hides which covered the soldiers tents and carriages to be stuffed with straw, and then tied together, and thrown into the river. Having crossed the Oxus, he marched directly towards the camp of Bessus, where when he arrived, he found it abandoned; but received at the same time letters from Spitamenes and Dataphernes, who were the chief commanders under Bessus, signifying, that, if he would send a small party to receive Bessus, they would deliver him into his hands; which they did accordingly, and the traitor was put to death in the manner related in the history of PERSIA. Macedon.

A supply of horses being now arrived, the Macedonian cavalry were remounted. Alexander continued his march to Maracanda the capital of Sogdia, from whence he advanced to the river Iaxartes. Here he performed great exploits against the Scythians; from whom, however, tho' he overcame them, his army suffered much; and the revolted Sogdians being headed by Spitamenes, gave him a great deal of trouble. Here he married Roxana the daughter of Oxyartes, a prince of the country whom he had subdued. But during these expeditions, the king greatly disgusted his army by the murder of his friend Clytus in a drunken quarrel at a banquet, and by his extravagant vanity in claiming divine honours.

91 Alexander marries Roxana.

92 Passes the Indus

At last he arrived at the river Indus, where Hephæstion and Perdiccas had already provided a bridge of boats for the passage of the army. The king refreshed his troops for 30 days in the countries on the other side of the river, which were those of his friend and ally Taxiles, who gave him 30 elephants, and joined his army now with 700 Indian horse, to which, when they were to enter upon action, he afterwards added 5000 foot. The true reason of this seems to have been his enmity to Porus, a famous Indian prince, whose territories lay on the other side of the river Hydaspes. During this recess, the king sacrificed with great solemnity; receiving also ambassadors from Ambisurus, a very potent prince, and from Doxareas, who was likewise a king in those parts, with tenders of their duty, and considerable presents. These ceremonies over, Alexander appointed Philip governor of Taxila, and put a Macedonian garrison into the place, because he intended to erect an hospital there for the cure of his sick and wounded soldiers. He then ordered the vessels, of which his bridge had been composed when he passed the Indus, to be taken to pieces, that they might be brought to the Hydaspes, where he was informed that Porus with a great army lay encamped to hinder his passage. When he approached the banks of this river with his army and the auxiliaries under the command of Taxiles, he found that the people he had to do with were not so easily to be subdued as the Persians and other Asiatics. The Indians were not only a very tall and robust, but also a very hardy and well-disciplined people; and their king Porus was a prince of high spirit, invincible courage, and great conduct.

It was about the summer solstice when Alexander reached the Hydaspes, and consequently its waters were broader, deeper, and more rapid, than at any other time; for in India the rivers swell as the sun's increasing heat melts the snow, and subside again as winter approaches. Alexander therefore had every difficulty to struggle with. Porus had made his dispositions so judiciously, that Alexander found it impossible to practise upon him as he had done upon others, and to pass the river in his view: wherefore he was constrained to divide his army into small parties, and to practise other arts, in order to get the better of so vigilant a prince. To this end he caused a great quantity of corn and other provisions to be brought into

Macedon. his camp; giving out, that he intended to remain where he was till the river fell, and by becoming fordable ſhould give him an opportunity of forcing a paſſage; this did not, however, hinder Porus from keeping up very ſtrict diſcipline in his camp; which when Alexander perceived, he frequently made ſuch motions as ſeemed to indicate a change of his reſolution, and that he had ſtill thoughts of paſſing the river. The main thing the Macedonians ſtood in fear of were the elephants; for the bank being pretty ſteep on the other ſide, and it being the nature of horſes to ſtart at the firſt appearance of thoſe animals, it was foreſeen that the army would be diſordered, and incapable of ſuſtaining the charge of Porus's troops.

93 And the Hydaſpes with difficulty.

At length Alexander paſſed the river by the following contrivance. There was, at the diſtance of 150 ſtadia from his camp, a rocky promontory projecting into the river, thick covered with wood; and over-againſt this promontory there lay a pretty large uninhabited iſland almoſt overgrown with trees. The king therefore conceived within himſelf a project of conveying a body of troops from this promontory into that iſland; and upon this ſcheme he built his hopes of ſurpriſing Porus, vigilant as he was. To this end he kept him and his army conſtantly alarmed for many nights together, till he perceived that Porus apprehended it was only done to haraſs his troops, and therefore no longer drew out of his camp, but truſted to his ordinary guards: then Alexander reſolved to put his deſign in execution. A conſiderable body of horſe, the Macedonian phalanx, with ſome corps of light-armed foot, he left in his camp under the command of Craterus, as alſo the auxiliary Indians; giving theſe orders to be obſerved in his abſence, that if Porus marched againſt him with part of his army and left another part with the elephants behind in his camp, Craterus and his forces ſhould remain where they were; but if it ſo happened that Porus withdrew his elephants, then Craterus was to paſs the river, becauſe his cavalry might then do it ſafely. Alexander having marched half the way, or about nine of our miles, ordered the mercenary troops under the command of Attalus and other generals, to remain there; and directed them, that as ſoon as he knew he was engaged with the Indians on the other ſide, they ſhould paſs in veſſels provided for that purpoſe, in order to aſſiſt him. Then marching a long way about, that the enemy might not perceive his deſign of reaching the rock, he advanced as diligently as he could towards that poſt. It happened very fortunately for him, that a great ſtorm of thunder, lightning, and hail, roſe in the night, whereby his march was perfectly concealed, his veſſels of 30 oars put together, and his tents ſtuffed and ſtitched, ſo that they paſſed from the rock into the iſland, without being perceived, a little before break of day; the ſtorm ceaſing juſt as he and his ſoldiers were ready for their paſſage. When they had traverſed the iſland, they boldly ſet forward to gain the oppoſite ſhore in ſight of Porus's out-guards, who inſtantly poſted away to give their maſter an account of the attempt. Alexander landed firſt himſelf, and was followed as expeditiouſly as poſſible by his forces, whom he took care to draw up as faſt as they arrived. When they began their march again, they found that their good fortune was not ſo great as at firſt they eſteemed it; for it appeared now, that they had not reached the continent at all, but were in truth in another iſland much larger than the former. They croſſed it as faſt as they could, and found that it was divided from the *terra firma* by a narrow channel, which, however, was ſo ſwelled by the late heavy rain, that the poor ſoldiers were obliged to wade up to the breaſt. When they were on the other ſide, the king drew them up again carefully, ordering the foot to march ſlowly, they being in number about 6000, while himſelf with 5000 horſe advanced before. As ſoon as Porus received intelligence that Alexander was actually paſſing the river, he ſent his ſon with 2000 horſe, and 120 armed chariots, to oppoſe him. But they came too late: Alexander was already got on ſhore, and even on his march. Macedon.

94 The ſon of Porus defeated and killed.

When the Macedonian ſcouts perceived them advance, they informed the king, who ſent a detachment to attack them, remaining ſtill at the head of his cavalry in expectation of Porus. But when he found that this party was unſupported, he inſtantly attacked with all his horſe, and defeated them with the ſlaughter of many, and the loſs of all their armed chariots, the ſon of Porus being ſlain in the fight. The remainder of the horſe returning to the camp with this diſaſtrous account, Porus was in ſome confuſion: however, he took very quickly the beſt and wiſeſt reſolutions his circumſtances would allow; which were, to leave a part of his army, with ſome of his elephants, to oppoſe Craterus, who was now about to paſs the river alſo; and, with the reſt, to march againſt Alexander and his forces, who were already paſſed. This reſolution once taken, he marched immediately out of his camp, at the head of 4000 horſe, 30,000 foot, 300 chariots, and 200 elephants. He advanced as expeditiouſly as he could, till he came into a plain which was firm and ſandy, where his chariots and elephants might act to advantage: there he halted, that he might put his army in order, knowing well that he need not go in queſt of his enemy. Alexander ſoon came up with his horſe, but he did not charge Porus; on the contrary, he halted, and put his troops in order, that they might be able to defend themſelves in caſe they were attacked. When he had waited ſome time, his foot arrived; whom he immediately ſurrounded with his horſe, that, after ſo fatiguing a march, they might have time to cool and breathe themſelves, before they were led to engage. Porus permitted all this, becauſe it was not his intereſt to fight, and becauſe he depended chiefly upon his order of battle, the elephants covering his foot, ſo that the Macedonians could not charge them.

95 Porus himſelf defeated.

When Alexander had diſpoſed his foot in proper order, he placed his horſe on the wings: and, obſerving that he was much ſuperior in them to the enemy, and that the cavalry of Porus were eaſy to be charged, he reſolved to let the foot have as little ſhare as poſſible in the battle. To this end, having given the neceſſary directions to Cœnus who commanded them, he went himſelf to the right, and with great fury fell upon the left wing of Porus. The diſpute, tho' ſhort, was very bloody: the cavalry of Porus, tho' they fought gallantly, were quickly broken; and the foot being by this means uncovered, the Macedonians charged them. But the Indian horſe rallying, came up to their relief, yet were again defeated. By this time the archers had

wounded

Macedon.

wounded many of the elephants, and killed moſt of their riders, ſo that they did not prove leſs troubleſome and dangerous to their own ſide than to the Macedonians; whence a great confuſion enſued: and Cœnus, taking this opportunity, fell in with the troops under his command, and entirely defeated the Indian army. Porus himſelf behaved with the greateſt intrepidity, and with the moſt excellent conduct: he gave his orders, and directed every thing, as long as his troops retained their form; and, when they were broken, he retired from party to party as they made ſtands, and continued fighting till every corps of Indians was put to the rout. In the mean time Craterus had paſſed with the reſt of the Macedonian army; and theſe, falling upon the flying Indians, increaſed the ſlaughter of the day exceſſively, inſomuch that 20,000 foot and 3000 horſe were killed, all the chariots were hacked to pieces, and the elephants not killed were taken: two of Porus's ſons fell here, as alſo moſt of his officers of all ranks.

As for Porus, Alexander gave ſtrict directions that no injury might be done to his perſon: he even ſent Taxiles to perſuade him to ſurrender himſelf, and to aſſure him that he ſhould be treated with all the kindneſs and reſpect imaginable; but Porus, diſdaining this advice from the mouth of an old enemy, threw a javelin at him, and had killed him but for the quick turn of his horſe. Meroe the Indian, who was alſo in the ſervice of Alexander, ſucceeded better: he had been the old acquaintance of Porus; and therefore when he intreated that prince to ſpare his perſon, and to ſubmit

96
He ſubmits to Alexander.

himſelf to fortune and a generous victor, Porus followed his advice; and we may truly ſay, that the condition of this Indian king ſuffered nothing by the loſs of the battle. Alexander immediately gave him his liberty, reſtored him ſhortly after to his kingdom, to which he annexed provinces almoſt equal to it in value. Neither was Alexander a loſer by his munificence; for Porus remained his true friend and conſtant ally.

To perpetuate the memory of this victory, Alexander ordered two cities to be erected; one on the field of battle, which he named *Nicæa*; the other on this ſide the river, which he called *Bucephala*, in honour of his horſe Bucephalus, who died here, as Arrian ſays, of mere old age, being on the verge of 30. All the ſoldiers, who fell in battle, he buried with great honours; offered ſolemn ſacrifices to the gods, and exhibited pompous ſhows on the banks of the Hydaſpes, where he had forced his paſſage. He then entered the territories of the Glauſæ, in which were 37 good cities, and a multitude of populous villages. All theſe were delivered up to him without fighting; and as ſoon as he received them, he preſented them to Porus; and having reconciled him to Taxiles, he ſent the latter home to his own dominions. About this time ambaſſadors arrived from ſome Indian princes with their ſubmiſſions; and Alexander having conquered the dominions of another Porus, which lay on the Hydraotes a branch of the Indus, added them to thoſe of Porus his ally.

In the middle of all this ſucceſs, however, news arrived, that the Cathei, the Oxydracæ, and the Malli, the moſt warlike nations of India, were confederated againſt the Macedonians, and had drawn together a great army. The king immediately marched to give them battle; and in a few days reached a city called *Sangala*, ſeated on the top of an hill, and having a fine lake behind it. Before this city the confederate Indians lay encamped, having three circular lines of carriages locked together, and their tents pitched in the centre. Notwithſtanding the apparent difficulty of forcing theſe intrenchments, Alexander reſolved immediately to attack them. The Indians made a noble defence; but at laſt the firſt line of their carriages was broken, and the Macedonians entered. The ſecond was ſtronger by far; yet Alexander attacked that too, and after a deſperate reſiſtance forced it. The Indians, without truſting to the third, retired into the city; which Alexander would have inveſted: but the foot he had with him not being ſufficient for that purpoſe, he cauſed his works to be carried on both ſides as far as the lake; and, on the other ſide of that, ordered ſeveral brigades of horſe to take poſt; ordering alſo battering engines to be brought up, and in ſome places employing miners. The ſecond night, he received intelligence that the beſieged, knowing the lake to be fordable, intended to make their eſcape through it. Upon this the king ordered all the carriages which had been taken in forcing their camp to be placed up and down the roads, in hopes of hindering their flight; giving directions to Ptolemy, who commanded the horſe on the other ſide of the lake, to be extremely vigilant, and to cauſe all his trumpets to ſound, that the forces might repair to that poſt where the Indians made their greateſt effort. Theſe precautions had all the effect that could be deſired: for of the few Indians who got through the lake, and paſſed the Macedonian horſe, the greater part were killed on the roads; but the greateſt part of their army was conſtrained to retire again through the water into the city. Two days after, the place was taken by ſtorm. Seventeen thouſand Indians were killed; 70,000 taken priſoners; with 300 chariots, and 500 horſe. The Macedonians are ſaid to have loſt only 100 men in this ſiege; but they had 1200 wounded, and among theſe ſeveral perſons of great diſtinction.

Macedon.

97
Sangala taken,

The city was no ſooner taken, than Alexander diſpatched Eumenes his ſecretary, with a party of horſe, to acquaint the inhabitants of the cities adjacent with what had befallen the Sangalans; promiſing alſo, that they ſhould be kindly treated if they would ſubmit. But they were ſo much affrighted at what had happened to their neighbours, that, abandoning all their cities, they fled into the mountains; chooſing rather to expoſe themſelves to wild beaſts, than to theſe invaders, who had treated their countrymen ſo cruelly. When the king was informed of this, he ſent detachments of horſe and foot to ſcour the roads; and theſe, finding aged, infirm, and wounded people, to the number of about 500, put them to the ſword without mercy. Perceiving that it was impoſſible to perſuade the inhabitants to return, he cauſed the city of Sangala to be raſed, and gave the territories to the few Indians who had ſubmitted to him.

98
And raſed.

Alexander, ſtill unſated with conqueſt, now prepared to paſs the Hyphaſis. The chief reaſon which induced him to think of this expedition was, the information he had received of the ſtate of the countries

Macedon. beyond that river. He was told that they were in themſelves rich and fruitful; that their inhabitants were not only a very martial people, but very civilized; that they were governed by the nobility, who were themſelves ſubject to the laws; and that as they lived in happineſs and freedom, it was likely they would fight obſtinately in defence of thoſe bleſſings. He was farther told, that among theſe nations there were the largeſt, ſtrongeſt, and moſt uſeful elephants bred and tamed; and was therefore fired with an earneſt deſire to reduce ſuch a bold and brave people under his rule, and of attaining to the poſſeſſion of the many valuable things that were ſaid to be amongſt them. As exorbitant, however, as his perſonal ambition was, he found it impoſſible to infuſe any part of it into the minds of his ſoldiers; who were ſo far from wiſhing to triumph over new and remote countries, that they were highly deſirous of leaving thoſe that they had already conquered. When therefore they were informed of the king's intentions, they privately conſulted together in the camp about the ſituation of their own affairs. At this conſultation, the graveſt and beſt of the ſoldiers lamented that they were made uſe of by their king, not as lions, who fall fiercely upon thoſe who have injured them; but as maſtiffs, who fly upon and tear thoſe who are pointed out to them as enemies. The reſt were not ſo modeſt; but expreſſed themſelves roundly againſt the king's humour for leading them from battle to battle, from ſiege to ſiege, and from river to river; proteſting that they would follow him no further, nor laviſh away their lives any longer, to purchaſe fame for him.

99 Alexander's troops refuſe to proceed further.

Alexander was a man of too much penetration not to be early in perceiving that his troops were very uneaſy. He therefore harangued them from his tribunal; but though his eloquence was great, and the love his army had for him was yet very ſtrong, they did not relent. For ſome time the ſoldiers remained ſullen and ſilent; and at laſt turned their eyes on Cœnus, an old and experienced general, whom Alexander loved, and in whom the army put great confidence.—He had the generoſity to undertake their cauſe; and told Alexander frankly, "that men endured toil in hopes of repoſe; that the Macedonians were already much reduced in their numbers; that of thoſe who remained, the greater part were invalids; and that they expected, in conſideration of their former ſervices, that he would now lead them back to their native country: an act which, of all others, would moſt contribute to his own great deſigns; ſince it would encourage the youth of Macedon, and even of all Greece, to follow him in whatever new expedition he pleaſed to undertake." The king was far from being pleaſed with this ſpeech of Cœnus, and much leſs with the diſpoſition of his army, which continued in a deep ſilence. He therefore diſmiſſed the aſſembly: but next day he called another, wherein he told the ſoldiers plainly, that he would not be driven from his purpoſe; that he would proceed in his conqueſts with ſuch as ſhould follow him voluntarily: as for the reſt, he would not detain them, but would leave them at liberty to go home to Macedon, where they might publiſh, "that they had left their king in the midſt of his enemies." Even this expedient had no ſucceſs; his army was ſo thoroughly tired with long marches and deſperate battles, that they were determined to go no further, either for fair ſpeeches or foul. Upon this Alexander retired to his tent, where he refuſed to ſee his friends, and put on the ſame gloomy temper that reigned among his troops. For three days things remained in this ſituation. At laſt the king ſuddenly appeared; and, as if he had been fully determined to purſue his firſt deſign, he gave orders for ſacrificing for the good ſucceſs of his new undertaking. Ariſtander the augur reported, that the omens were altogether inauſpicious; upon which the king ſaid, that ſince his proceeding farther was neither pleaſing to the gods nor grateful to his army, he would return. When this was rumoured among the army, they aſſembled in great numbers about the royal tent, ſaluting the king with loud acclamations, wiſhing him ſucceſs in all his future deſigns; giving him at the ſame time hearty thanks, for that "he who was invincible had ſuffered himſelf to be overcome by their prayers." Macedon.

100 He conſents to return.

A ſtop being thus put to the conqueſts of Alexander, he determined to make the Hyphaſis the boundary of his dominions; and having erected twelve altars of an extraordinary magnitude, he ſacrificed on them: after which he exhibited ſhows in the Grecian manner; and, having added all the conquered country in theſe parts to the dominions of Porus, he began to return. Having arrived at the Hydaſpes, he made the neceſſary preparations for ſailing down the Indus into the ocean. For this purpoſe, he ordered vaſt quantities of timber to be felled in the neighbourhood of the Hydaſpes, through which he was to ſail into the Indus; he cauſed the veſſels with which he had paſſed other rivers to be brought thither, and aſſembled a vaſt number of artificers capable of repairing and equipping his fleet; which, when finiſhed, conſiſted of 80 veſſels of three banks of oars, and 2000 leſſer ſhips and tranſports. Thoſe who were to manage this fleet were collected out from the Phœnicians, Cyprians, Carians, and Egyptians following his army, and who were reckoned perfectly well ſkilled in the naval art. When all things were ready, the army embarked about break of day; the king, in the mean time, ſacrificing to the gods according to the ceremonies uſed in his own country, and likewiſe according to thoſe of the country where he now was. Then he himſelf went on board; and cauſing the ſignal to be given by ſound of trumpet, the fleet ſet ſail. Craterus and Hephæſtion had marched ſome days before with another diviſion of the army; and in three days the fleet reached that part of the river which was oppoſite to their camps. Here he had information, that the Oxydracæ and Malli were raiſing forces to oppoſe him: upon which he immediately determined to reduce them; for, during this voyage, he made it a rule to compel the inhabitants on both ſides of the river to yield him obedience. But before he arrived on the coaſts of the people above mentioned, he himſelf ſuſtained no ſmall danger; for, coming to the confluence of the Aceſines with the Hydaſpes, from whence both rivers roll together into the Indus, the eddies, whirlpools, and rapid currents, ruſhing with tremendous noiſe from the reſpective channels of thoſe rivers into the great one formed by them both, at once terrified thoſe who navigated his veſſels, and actually

101 Sails down the Indus.

Macedon. tually deſtroyed many of the long veſſels, with all who were aboard of them; the king himſelf being in ſome danger, and Nearchus the admiral not a little at a loſs. As ſoon as this danger was over, Alexander went on ſhore; and having ordered his elephants with ſome troops of horſe and archers to be carried acroſs, and put under the command of Craterus, he then divided his army on the left-hand bank into three bodies; the firſt commanded by himſelf, the ſecond by Hyphæſtion, and the third by Ptolemy. Hyphæſtion had orders to move ſilently through the heart of the country, five days march before the king; that if, on Alexander's approach, any of the barbarians ſhould attempt to ſhelter themſelves by retiring into the country, they might fall into the hands of Hephæſtion. Ptolemy Lagus was ordered to march three days journey behind the king, that if any eſcaped his army, they might fall into Ptolemy's hands; and the fleet had orders to ſtop at the confluence of this river with the Hydraotes till ſuch time as theſe ſeveral corps ſhould arrive.

102 His expedition againſt the Malli.

Alexander himſelf, at the head of a body of horſe and light armed foot, marched through a deſart country againſt the Malli; and, ſcarce affording any reſt to his ſoldiers, arrived in three days at a city into which the barbarians had put their wives and children, with a good garriſon for their defence. The country people, having no notion that Alexander would march through ſuch a deſert and barren region, were all unarmed, and in the utmoſt confuſion. Many of them therefore were ſlain in the field; the reſt fled into the city, and ſhut the gates. But this only protracted their fate for a ſhort time; for the king, having ordered the city to be inveſted by his cavalry, took it, as well as the caſtle, by ſtorm, and put all he found there to the ſword. He ſent at the ſame time Perdiccas with a conſiderable detachment, to inveſt another city of the Malli at a conſiderable diſtance; but when he came there, he found it abandoned. However, he purſued the inhabitants who had but lately left it, and killed great numbers of them on the road. After this the king took ſeveral other cities, but not without conſiderable reſiſtance; for the Indians ſometimes choſe to burn themſeves in their houſes rather than ſurrender. At laſt he marched to their capital city; and finding that abandoned, he proceeded to the river Hydraotes, where he found 50,000 men encamped on the oppoſite bank, in order to diſpute his paſſage. He did not heſitate, however, to enter the river with a conſiderable party of horſe: and ſo much were the Indians terrified at his preſence, that their whole army retired before him. In a ſhort time they returned and attacked him, being aſhamed to fly before ſuch an inconſiderable number; but in the mean time the reſt of the Macedonian forces came up, and the Indians were obliged to retire to a city which lay behind them, and which Alexander inveſted that very night. The next day he ſtormed the city with ſuch violence, that the inhabitants were compelled to abandon it, and to retire to the caſtle, where they prepared for an obſtinate defence. The king inſtantly gave orders for ſcaling the walls, and the ſoldiers prepared to execute theſe orders as faſt as they could; but the king being impatient caught hold of a ladder and mounted it firſt himſelf, being followed by Leonatus, Peuceſtas, and Abreas, the latter a man of great valour, and who on that account had double pay allowed him. The king having gained the top of the battlements, cleared them quickly of the defendants, killing ſome of them with his ſword, and puſhing others over the walls: but after this was done, he was in more danger than ever; for the Indians galled him with their arrows from the adjacent towers, though they durſt not come near enough to engage him. His own battalion of targeteers mounting in haſte to ſecond him, broke the ladders; which, as ſoon as Alexander perceived, he threw himſelf down into the caſtle, as did alſo Peuceſtas, Leonatus, and Abreas. As ſoon as the king was on the ground, the Indian general ruſhed forward to attack him; but Alexander inſtantly diſpatched him, as well as ſeveral others who followed him. Upon this the reſt retired, and contented themſelves with throwing darts and ſtones at him at a diſtance. Abreas was ſtruck into the head with an arrow, and died on the ſpot; and, ſhortly after, another pierced through the king's breaſtplate into his body. As long as he had ſpirits, he defended himſelf valiantly; but, through a vaſt effuſion of blood, loſing his ſenſes, he fell upon his ſhield. Peuceſtas then covered him with the ſacred ſhield of Pallas on one ſide, as did Leonatus with his own ſhield on the other, though they themſelves were dreadfully wounded. In the mean time, however, the ſoldiers on the outſide, eager to ſave their king, ſupplied their want of ladders by driving large iron pins into the walls. By the help of theſe many of them aſcended, and came to the aſſiſtance of Alexander and his companions. The Indians were now ſlaughtered without mercy; but Alexander continued for ſome time in a very dangerous way: however, he at laſt recovered his ſtrength, and ſhowed himſelf again to his army, which filled them with the greateſt joy.

Macedon.

103 His deſperate valour and danger.

104 Is with difficulty ſaved by his men.

The Malli, being now convinced that nothing but ſubmiſſion could ſave the remainder of them, ſent deputies to Alexander, offering the dominion of their country; as did alſo the Oxydracæ: and the king having ſettled every thing in theſe countries agreeable to his mind, proceeded on his voyage down the river Indus. In this voyage he received the ſubmiſſion of ſome other Indian princes; and perceiving, that, at the point of the iſland Pattala, the river divided itſelf into two vaſt branches, he ordered an haven and convenient docks to be made there for his ſhips; and when he had careened his fleet, he ſailed down the right-hand branch towards the ocean. In his paſſage he ſuſtained great difficulties by reaſon of his want of pilots, and at the mouth of the river very narrowly miſſed being caſt away: yet all this did not hinder him from purſuing his firſt deſign, though it does not appear that he had any other motive thereto than the vain deſire of boaſting that he had entered the ocean beyond the Indus: for, having conſecrated certain bulls to Neptune, and thrown them into the ſea, performed certain libations of golden cups, and thrown the cups alſo into the ſea, he came back again; having only ſurveyed two little iſlands, one at the mouth of the Indus, and one a little farther in the ocean.

105 He proceeds in his voyage down the Indus.

On the king's return to Pattala, he reſolved to ſail down the other branch of the Indus, that he might

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Macedon. see whether it was more safe and commodious for his fleet than that which he had already tried; and for this he had very good reasons. He had resolved to send Nearchus with his fleet by sea, through the Persian gulf up the river Tygris, to meet him and his army in Mesopotamia; but as the possibility of this voyage depended on the ceasing of the Etesian winds, there was a necessity of laying up the fleet till the season should prove favourable. Alexander, therefore, sailing through this branch of the Indus, sought on the sea-coast for bays and creeks, where his fleet might anchor in safety; he caused also pits to be sunk, which might be filled with fresh water for the use of his people; and took all imaginable precautions for preserving them in ease and safety till the season would allow them to continue their voyage. In this he succeeded to his wish; for he found this branch of the river Indus, at its mouth, spread over the plain country and forming a kind of lake, wherein a fleet might ride with safety. He therefore appointed Leonatus, and a part of his army, to carry on such works as were necessary; causing them to be relieved by fresh troops as often as there was occasion: then having given his last instructions to Nearchus, he departed with the rest of the army, in order to march back to Babylon.

106 Sets out for Babylon.

Before the king's departure, many of his friends advised him against the route which he intended to take. They told him, that nothing could be more rash or dangerous than this resolution. They acquainted him, that the country through which he was to travel was a wild uncultivated desart; that Semiramis, when she led her soldiers this way out of India, brought home but 20 of them; and that Cyrus, attempting to do the same, returned with only seven. But all this was so far from deterring Alexander, that it more than ever determined him to pursue no other road. As soon, therefore, as he had put things in order, he marched at the head of a sufficient body of troops to reduce the Oritæ, who had never vouchsafed either to make their submission or to court his friendship. Their territories lay on the other side of a river called *Arabis*, which Alexander crossed so speedily, that they had no intelligence of his march; whereupon most of them quitted their country, and fled into the deserts. Their capital he found so well situated, that he resolved to take it out of their hands, and to cause a new and noble city to be founded there, the care of which he committed to Hephæstion. Then he received the deputies of the Oritæ and Gedrosi; and having assured them, that if the people returned to their villages, they should be kindly treated, and having appointed Apollophenes president of the Oritæ, and left a considerable body of troops under Leonatus to secure their obedience, he began his march through Gedrosia. In this

107 His dangerous march through Gedrosia.

march his troops suffered incredible hardships. The road was very uncertain and troublesome, on account of its lying thro' deep and loose sands, rising in many places into hillocks, which forced the soldiers to climb, at the same time that it sunk under their feet; there were no towns, villages, nor places of refreshment, to be met with; so that, after excessive marches, they were forced to encamp among these dry sands. As to provisions, they hardly met with any during their whole march. The soldiers were therefore obliged to kill their beasts of carriage: and such as were sent to bring some corn from the sea-side, were so grievously distressed, that, though it was sealed with the king's signet, they cut open the bags, choosing rather to die a violent death for disobedience than perish by hunger. When the king, however, was informed of this, he freely pardoned the offenders; he was also forced to accept the excuses that were daily made for the loss of mules, horses, &c. which were in truth eaten by the soldiers, and their carriages broken in pieces to avoid further trouble. As for water, their want of it was a great misfortune; and yet their finding it in plenty was sometimes a greater: for, as by the first they perished with thirst, so by the latter they were burst, thrown into dropsies, and rendered incapable of travel. Frequently they met with no water for the whole day together: sometimes they were disappointed of it at night; in which case, if they were able, they marched on; so that it was common with them to travel 30, 40, 50, or even 60 miles without encamping. Numbers through these hardships were obliged to lag in the rear; and of these many were left behind, and perished; for indeed scarce any ever joined the army again. Their miseries, however, they sustained with incredible patience, being encouraged by the example of their king; who, on this occasion, suffered greater hardships than the meanest soldier in his army. At last they arrived at the capital of Gedrosia, where they refreshed themselves, and staid some time: after which, they marched into Caramania; which being a very plentiful country, they there made themselves ample amends for the hardships and fatigues they had sustained. Here they were joined first by Craterus with the troops under his command, and a number of elephants; then came Stasanor president of the Arians, and Phariſmanes the son of Phrataphernes governor of Parthia. They brought with them camels, horses, and other beasts of burden, in vast numbers; having foreseen, that the king's march thro' Gedrosia would be attended with the loss of the greatest part, if not of all the cavalry and beasts belonging to his army.

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108 He arrives in Caramania.

During Alexander's stay in Caramania, he redressed the injuries of his people, who had been grievously oppressed by their governors during his absence. Here also he was joined by his admiral Nearchus, who brought him an account that all under his command were in perfect safety, and in excellent condition; with which the king was mightily pleased, and, after having bestowed on him singular marks of his favour, sent him back to the navy. Alexander next set out for Persia, where great disorders had been committed during his absence. These also he redressed, and caused the governor to be crucified; appointing in his room Peucestas, who saved his life when he fought singly against a whole garrison as above related. The new governor was no sooner invested with his dignity, than he laid aside the Macedonian garb, and put on that of the Medes; being the only one of Alexander's captains, who, by complying with the manners of the people he governed, gained their affection.

109 Redresses the grievances of his people.

While Alexander visited the different parts of Persia, he took a view, among the rest, of the ruins of Persepolis, where he is said to have expressed great sorrow for the destruction he had formerly occasioned. From Persepolis he marched to Susa, where he gave

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an extraordinary looſe to pleaſure; reſolving to make himſelf and his followers ſome amends for the difficulties they had hitherto undergone; purpoſing at the ſame time ſo effectually to unite his new conquered with his hereditary ſubjects, that the jealouſies and fears, which had hitherto tormented both, ſhould no longer ſubſiſt. With this view he married two wives of the blood royal of Perſia; viz. Barſine, or Statira, the daughter of Darius, and Paryſatis the daughter of Ochus. Drypetis, another daughter of Darius, he gave to Hephæſtion; Amaſtrine, the daughter of Oxyartes the brother of Darius, married Craterus; and to the reſt of his friends, to the number of 80, he gave other women of the greateſt quality. All theſe marriages were celebrated at once, Alexander himſelf beſtowing fortunes upon them; he directed likewiſe to take account of the number of his officers and ſoldiers who had married Aſiatic wives; and tho' they appeared to be 10,000, yet he gratified each of them according to his rank. He next reſolved to pay the debts of his army, and thereupon iſſued an edict directing every man to regiſter his name and the ſum he owed; with which the ſoldiers complying ſlowly, from an apprehenſion that there was ſome deſign againſt them, Alexander ordered tables heaped with money to be ſet in all quarters of the camp, and cauſed every man's debts to be paid on his bare word, without even making any entry of his name; though the whole ſum came to 20,000 talents. On ſuch as had diſtinguiſhed themſelves in an extraordinary manner, he beſtowed crowns of gold. Peuceſtas had the firſt; Leonatus the ſecond; Nearchus the third; Oneſicritus the fourth; Hephæſtion the fifth; and the reſt of his guards had each of them one. After this he made other diſpoſitions for conciliating, as he ſuppoſed, the differences among all his ſubjects. He reviewed the 30,000 youths, whom at his departure for India he had ordered to be taught Greek and the Macedonian diſcipline; expreſſing high ſatisfaction at the fine appearance they made, which rendered them worthy of the appellation he beſtowed on them, viz. that of *Epigoni*, i. e. ſucceſſors. He promoted alſo, without any diſtinction of nation, all thoſe who had ſerved him faithfully and valiantly in the Indian war. When all theſe regulations were made, he gave the command of his heavy armed troops to Hephæſtion, and ordered him to march directly to the banks of the Tigris, while in the mean time a fleet was equipped for carrying the king and the troops he retained with him down to the ocean.

110 Marries other two wives.

111 Pays the debts of his army.

Thus ended the exploits of Alexander; the greateſt conqueror that ever the world ſaw, at leaſt with reſpect to the rapidity of his conqueſts. In 12 years time he had brought under his ſubjection Egypt, Libya, Aſia Minor, Syria, Phœnicia, Paleſtine, Babylonia, Perſia, with part of India and Tartary. Still, however, he meditated greater things. He had now got a great taſte in maritime affairs; and is ſaid to have meditated a voyage to the coaſts of Arabia and Ethiopia, and thence round the whole continent of Africa to the Straits of Gibraltar. But of this there is no great certainty; though that he intended to ſubdue the Carthaginians and Italians, is more than probable. All theſe deſigns, however, were fruſtrated by his death, which happened at Babylon in 323 B. C. He is ſaid to have received ſeveral warnings of his approaching fate, and to have been adviſed to avoid that city; which advice he either deſpiſed or could not follow. He died of a fever after eight days illneſs, without naming any ſucceſſor; having only given his ring to Perdiccas, and left the kingdom, as he ſaid, *to the moſt worthy*.

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112 He dies at Babylon.

The character of this great prince has been variouſly repreſented; but moſt hiſtorians ſeem to have looked upon him rather as an illuſtrious madman than one upon whom the epithet of *Great* could be properly beſtowed. From a careful obſervation of his conduct, however, it muſt appear, that he poſſeſſed not only a capacity to plan, but likewiſe to execute, the greateſt enterpriſes that ever entered into the mind of any of the human race. From whatever cauſe the notion originated, it is plain that he imagined himſelf a divine perſon, and born to ſubdue the whole world: and extravagant and impracticable as this ſcheme may appear at preſent, it cannot at all be looked upon in the ſame light in the time of Alexander. The Greeks were in his time the moſt powerful people in the world in reſpect to their ſkill in the military art, and the Perſians were the moſt powerful with reſpect to wealth and numbers. The only other powerful people in the world were the Carthaginians, Gauls, and Italian nations. From a long ſeries of wars which the Carthaginians carried on in Sicily, it appeared that they were by no means capable of contending with the Greeks even when they had an immenſe ſuperiority of numbers; much leſs then could they have ſuſtained an attack from the whole power of Greece and Aſia united. The Gauls and Italians were indeed very brave, and of a martial diſpoſition; but they were barbarous, and could not have reſiſted armies well diſciplined and under the command of ſuch a ſkilful leader as Alexander. Even long after his time, it appeared that the Romans themſelves could not have reſiſted the Greeks; ſince Regulus, after having defeated the Cathaginians and reduced them to the utmoſt diſtreſs, was totally unable to reſiſt a Carthaginian army commanded by a Greek general, and guided by Greek diſcipline.

113 His character.

Thus it appears, that the ſcheme of Alexander cannot by any means be accounted that of a madman, or of one who projects great things without judgment or means to execute them. If we conſider from his actions the end which moſt probably he had in view, could his ſcheme have been accompliſhed, we ſhall find it not only the greateſt but the *beſt* that can poſſibly be imagined. He did not conquer to deſtroy, enſlave, or oppreſs; but to civilize, and unite the whole world as one nation. No ſooner was a province conquered than he took care of it as if it had been part of his paternal inheritance. He allowed not his ſoldiers to oppreſs and plunder the Perſians, which they were very much inclined to do; on the contrary, by giving into the oriental cuſtoms himſelf, he ſtrove to extinguiſh that inveterate hatred which had ſo long ſubſiſted between the two nations. In the Scythian countries which he ſubdued, he purſued the ſame excellent plan. His courage and military ſkill, in which he never was excelled, were diſplayed, not with a view to rapine or deſultory conqueſt, but to civilize and induce the barbarous inhabitants to employ themſelves in a more proper

Macedon. per way of life. "Amidſt the hardſhips of a military life (ſays Dr Gillies), obſtinate ſieges, bloody battles, and dear bought victories, he ſtill reſpected the rights of mankind, and practiſed the mild virtues of humanity. The conquered nations enjoyed their ancient laws and privileges; the rigours of deſpotiſm ſoftened; arts and induſtry encouraged; and the proudeſt Macedonian governors compelled, by the authority and example of Alexander, to obſerve the rules of juſtice towards their meaneſt ſubjects. To bridle the fierce inhabitants of the Scythian plains, he founded cities and eſtabliſhed colonies on the banks of the Iaxartes and Oxus; and thoſe deſtructive campaigns uſually aſcribed to his reſtleſs activity and blind ambition, appeared to the diſcernment of this extraordinary man not only eſſential to the ſecurity of the conqueſts which he had already made, but neceſſary for the more remote and ſplendid expeditions which he ſtill purpoſed to undertake, and which he performed with ſingular boldneſs and unexampled ſucceſs."—In another place the ſame author gives his character in the following words.

"He was of a low ſtature, and ſomewhat deformed; but the activity and elevation of his mind animated and ennobled his frame. By a life of continual labour, and by an early and habitual practice of the gymnaſtic exerciſes, he had hardened his body againſt the impreſſions of cold and heat, hunger and thirſt, and prepared his robuſt conſtitution for bearing ſuch exertions of ſtrength and activity, as have appeared incredible to the undiſciplined ſoftneſs of modern times. In generoſity and in proweſs, he rivalled the greateſt heroes of antiquity; and in the race of glory, having finally outſtripped all competitors, became ambitious to ſurpaſs himſelf. His ſuperior ſkill in war gave uninterrupted ſucceſs to his arms; and his natural humanity, enlightened by the philoſophy of Greece, taught him to improve his conqueſts to the beſt intereſts of mankind. In his extenſive dominions, he built or founded not leſs than 70 cities; the ſituation of which being choſen with conſummate wiſdom, tended to facilitate communication, to promote commerce, and to diffuſe civility through the greateſt nations of the earth. It may be ſuſpected, indeed, that he miſtook the extent of human power, when in the courſe of one reign he undertook to change the face of the world; and that he miſcalculated the ſtubbornneſs of ignorance and the force of habit, when he attempted to enlighten barbariſm, to ſoften ſervitude, and to tranſplant the improvements of Greece into an African and Aſiatic ſoil, where they have never been known to flouriſh. Yet let not the deſigns of Alexander be too haſtily accuſed of extravagance. Whoever ſeriouſly conſiders what he actually performed before his 33d year, will be cautious of determining what he might have accompliſhed had he reached the ordinary term of human life. His reſources were peculiar to himſelf; and ſuch views as well as actions became him as would have become none beſides. In the language of a philoſophical hiſtorian, 'he ſeems to have been given to the world by a peculiar diſpenſation of Providence, being a man like to none other of the human kind.'

"From the part which his father Philip and himſelf acted in the affairs of Greece, his hiſtory has been tranſmitted through the impure channels of exaggerated flattery or malignant envy. The innumerable fictions, which diſgrace the works of his biographers, are contradicted by the moſt authentic accounts of his reign, and inconſiſtent with thoſe public tranſactions which concurring authorities confirm. In the preſent work it ſeemed unneceſſary to expatiate on ſuch topics, ſince it is leſs the buſineſs of hiſtory to repeat or even to expoſe errors than to ſelect and impreſs uſeful truths. An author, ambitious of attaining that purpoſe, can ſeldom indulge the language of general panegyric. He will acknowledge, that Alexander's actions were not always blameleſs; but, after the moſt careful examination, he will affirm, that his faults were few in number, and reſulted from his ſituation rather than from his character.

"From the firſt years of his reign he experienced the crimes of diſaffection and treachery, which multiplied and became more dangerous with the extent of his dominions and the difficulty to govern them. Several of his lieutenants early aſpired at independence; others formed conſpiracies againſt the life of their maſter. The firſt criminals were treated with a lenity becoming the generous ſpirit of Alexander: But when Philotas, the ſon of Parmenio, and even Parmenio himſelf, afforded reaſon to ſuſpect their fidelity; when the Macedonian youths, who, according to the inſtitution of Philip, guarded the royal pavilion, prepared to murder their ſovereign, he found it neceſſary to depart from his lenient ſyſtem, and to hold with a firmer hand the reins of government. Elated by unexampled proſperity, and the ſubmiſſive reverence of vanquiſhed nations, his loftineſs diſguſted the pride of his European troops, particularly the Macedonian nobles, who had been accuſtomed to regard themſelves rather as his companions than ſubjects. The pretenſions which ſound policy taught him to form and to maintain, of being treated with thoſe external honours ever claimed by the monarchs of the Eaſt, highly offended the religious prejudices of the Greeks, who deemed it impious to proſtrate the body or bend the knee to any mortal ſovereign. Yet had he remitted formalities conſecrated by the practice of ages, he muſt inſenſibly have loſt the reſpect of his Aſiatic ſubjects. With a view to reconcile the diſcordant principles of the victors and vanquiſhed, he affected an immediate deſcent from Jupiter Ammon, a claim liberally admitted by the avarice or fears of the Libyan prieſts; and which, he had reaſon to expect, could not be very obſtinately denied by the credulity of the Greeks and Macedonians, who univerſally acknowledged that Philip, his reputed father, was remotely deſcended from the Grecian Jupiter. But the ſucceſs of this deſign, which might have intitled him, as ſon of Jupiter, to the ſame obeiſance from the Greeks which the barbarians readily paid him as monarch of the Eaſt, was counteracted, at firſt by the ſecret diſpleaſure, and afterwards by the open indignation, of ſeveral of his generals and courtiers. Nor did the conduct of Alexander tend to extricate him from this difficulty. With his friends he maintained that equal intercourſe of viſits and entertainments which characteriſed the Macedonian manners; indulged the liberal flow of unguarded converſation; and often exceeded that intemperance in wine which diſgraced his age and country."

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We ſhall conclude this character of Alexander with obſerving, that he had in view, and undoubtedly muſt have accompliſhed, the ſovereignty of the ocean as well as of the land. The violent reſiſtance made by the Tyrians had ſhown him the ſtrength of a commercial nation; and it was undoubtedly with a view to enrich his dominions by commerce, that he equipped the fleet on the Indus, and wiſhed to keep up a communication with India by land as well as by ſea. "It was chiefly with a view to the latter of theſe objects (ſays Dr Robertſon), that he examined the navigation of the Indus with ſo much attention. With the ſame view, on his return to Suſa, he in perſon ſurveyed the courſe of the Euphrates and Tigris, and gave directions to remove the cataracts or dams with which the ancient monarchs of Perſia, induced by a peculiar precept of their religion, which enjoined them to guard with the utmoſt care againſt defiling any of the elements, had conſtructed near the mouths of theſe rivers, in order to ſhut out their ſubjects from any acceſs to the ocean. By opening the navigation in this manner, he propoſed, that the valuable commodities of India ſhould be conveyed from the Perſian Gulf into the interior parts of his Aſiatic dominions, while by the Arabian Gulf they ſhould be carried to Alexandria, and diſtributed to the reſt of the world.

"Grand and extenſive as theſe ſchemes were, the precautions employed, and the arrangements made for carrying them into execution, were ſo various and ſo proper, that Alexander had good reaſon to entertain ſanguine hopes of their proving ſucceſsful. At the time when the mutinous ſpirit of his ſoldiers obliged him to relinquiſh his operations in India, he was not 30 years of age complete. At this enterpriſing period of life, a prince of a ſpirit ſo active, perſevering, and indefatigable, muſt have ſoon found means to reſume a favourite meaſure on which he had been long intent. If he had invaded India a ſecond time, he would not, as formerly, have been obliged to force his way through hoſtile and unexplored regions, oppoſed at every ſtep by nations and tribes of barbarians whoſe names had never reached Greece. All Aſia, from the ſhores of the Ionian ſea to the banks of the Hyphaſis, would then have been ſubject to his dominion; and through that immenſe ſtretch of country he had eſtabliſhed ſuch a chain of cities or fortified ſtations, that his armies might have continued their march with ſafety, and have found a regular ſucceſſion of magazines provided for their ſubſiſtence. Nor would it have been difficult for him to bring into the field forces ſufficient to have atchieved the conqueſt of a country ſo populous and extenſive as India. Having armed and diſciplined his ſubjects in the Eaſt like Europeans, they would have been ambitious to imitate and to equal their inſtructors; and Alexander might have drawn recruits, not from his ſcanty domains in Macedonia and Greece, but from the vaſt regions of Aſia, which in every age has covered the earth, and aſtoniſhed mankind with its numerous armies. When at the head of ſuch a formidable power he had reached the confines of India, he might have entered it under circumſtances very different from thoſe in his firſt expedition. He had ſecured a firm footing there, partly by means of the garriſons which he left in the three cities which he had built and fortified, and partly by his alliance with Taxiles and Porus. Theſe two Indian princes, won by Alexander's humanity and beneficence, which, as they were virtues ſeldom diſplayed in the ancient mode of carrying on war, excited of courſe an higher degree of admiration and gratitude, had continued ſteady in their attachment to the Macedonians. Reinforced by their troops, and guided by their information as well as by the experience which he had acquired in his former campaigns, Alexander muſt have made rapid progreſs in a country where every invader from his time to the preſent age has proved ſucceſsful.

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"But this and all his other ſplendid ſchemes were terminated at once by his untimely death. In conſequence of that, however, events took place which illuſtrate and confirm the juſtneſs of the preceding ſpeculations and conjectures by evidence the moſt ſtriking and ſatisfactory. When that great empire, which the ſuperior genius of Alexander had kept united and in ſubjection, no longer felt his ſuperintending control, it broke into pieces, and its various provinces were ſeized by his principal officers, and parcelled out among them. From ambition, emulation, and perſonal animoſity, they ſoon turned their arms againſt one another; and as ſeveral of the leaders were equally eminent for political abilities and for military ſkill, the conteſt was maintained long, and carried on with frequent viciſſitudes of fortune. Amidſt the various convulſions and revolutions which theſe occaſioned, it was found that the meaſures of Alexander for the preſervation of his conqueſts had been concerted with ſuch ſagacity, that upon the final reſtoration of tranquillity, the Macedonian dominion continued to be eſtabliſhed in every part of Aſia, and not one province had ſhaken off the yoke. Even India, the moſt remote of Alexander's conqueſts, quietly ſubmitted to Pytho the ſon of Agenor, and afterwards to Seleucus, who ſucceſſively obtained dominion over that part of Aſia. Porus and Taxiles, notwithſtanding the death of their benefactor, neither declined ſubmiſſion to the authority of the Macedonians nor made any attempt to recover independence."

With the death of Alexander fell alſo the glory of the Macedonians; who very ſoon relapſed into a ſituation as bad, or worſe, than that in which they had been before the reign of Philip. This was occaſioned principally by his not having diſtinctly named a ſucceſſor, and having no child of his own come to the years of diſcretion to whom the kingdom might ſeem naturally to belong. The ambition and jealouſy of his mother Olympias, his queen Roxana, and eſpecially of the great commanders of his army, not only prevented a ſucceſſor from being ever named, but occaſioned the death of every perſon, whether male or female, who was in the leaſt related to Alexander. To have a juſt notion of the origin of theſe diſturbances, it is neceſſary in the firſt place to underſtand the ſituation of the Macedonian affairs at the time of Alexander's death.

114 Cauſes of the diſſolution of his empire.

When Alexander ſet out for Aſia, he left Antipater, as we formerly obſerved, in Macedon, to prevent any diſturbances that might ariſe either there or in Greece. The Greeks, even during the lifetime of Alexander, bore the ſuperiority which he exerciſed over them with great impatience; and, though nothing could be more

Macedon. gentle than the government of Antipater, yet he was exceedingly hated, becauſe he obliged them to be quiet. One of the laſt actions of Alexander's life ſet all Greece in a flame. He had, by an edict, directed all the cities of Greece to recal their exiles; which edict, when it was publiſhed at the Olympic games, created much confuſion. Many of the cities were afraid, that, when the exiles returned, they would change the government; moſt of them doubted their own ſafety if the edict took place; and all of them held this peremptory decree to be a total abolition of their liberty. No ſooner therefore did the news of Alexander's death arrive than they prepared for war.

In Aſia the ſtate of things was not much better; not indeed through any inclination of the conquered countries to revolt, but through the diſſenſions among the commanders.—In the general council which was called ſoon after the death of Alexander, after much confuſion and altercation, it was at laſt agreed, or rather commanded by the ſoldiers, that Aridæus the brother of Alexander, who had always accompanied the king, and had been wont to ſacrifice with him, ſhould aſſume the ſovereignty.—This Aridæus was a man of very ſlender parts and judgment, not naturally, but by the wicked practices of Olympias, who had given him poiſonous draughts in his infancy, leſt he ſhould ſtand in the way of her ſon Alexander or any of his family; and for this, or ſome other reaſon, Perdiccas, Ptolemy, and moſt of the horſe-officers, reſented his promotion to ſuch a degree, that they quitted the aſſembly, and even the city. However, Meleager, at the head of the phalanx, vigorouſly ſupported their firſt reſolution, and threatened loudly to ſhed the blood of thoſe who affected to rule over their equals, and to aſſume a kingdom which no way belonged to them. Aridæus was accordingly arrayed in royal robes, had the arms of Alexander put upon him, and was ſaluted by the name of *Philip*, to render him more popular. Thus were two parties formed, at the head of whom were Meleager and Perdiccas; both of them pretending vaſt concern for the public good, yet, at bottom, deſiring nothing more than their own advantage. Perdiccas was a man of high birth, had had a ſupreme command in the army, was much in favour with Alexander, and one in whom the nobility had put great confidence. Meleager was become formidable by having the phalanx on his ſide, and having the nominal king entirely in his power: for Aridæus, or Philip, was obliged to comply with whatever he thought proper; and publicly declared, that whatever he did was by the advice of Meleager; ſo that he made his miniſter accountable for his own ſchemes, and no way endangered himſelf. The Macedonians alſo, beſides their regard for the deceaſed king, ſoon began to entertain a perſonal love for Philip on account of his moderation.

115 Aridæus appointed king.

116 A party formed by Meleager, and another by Perdiccas.

It is remarkable, however, that notwithſtanding all the favours which Alexander had conferred upon his officers, and the fidelity with which they had ſerved him during his life, only two of them were attached to the intereſts of his family after his death. Theſe were Antipater and Eumenes the Cardian, whom he had appointed his ſecretary. Antipater, as we have already ſeen, was embroiled with the Greeks, and could not aſſiſt the royal family who were in Aſia; and Eumenes had not as yet ſufficient intereſt to form a party in their favour. In a ſhort time, however, Perdiccas prevailed againſt Meleager, and got him murdered; by which means the ſupreme power for a time fell into his hands. His firſt ſtep, in conſequence of this power, was to diſtribute the provinces of the empire among the commanders in the following manner, in order to prevent competitors, and to ſatisfy the ambition of the principal commanders of the army. Aridæus, and the ſon of Roxana, born after the death of his father, were to enjoy the regal authority. Antipater had the government of the European provinces. Craterus had the title of *protector*. Perdiccas was general of the houſehold troops in the room of Hephæſtion. Ptolemy the ſon of Lagus had Egypt, Libya, and that part of Arabia which borders upon Egypt. Cleomenes, a man of infamous character, whom Alexander had made receiver-general in Egypt, was made Ptolemy's deputy. Leomedon had Syria; Philotas, Cilicia; Pithon, Media; Eumenes, Cappadocia, Paphlagonia, and all the country bordering on the Euxine Sea, as far as Trapezus; but theſe were not yet conquered, ſo that he was a governor without a province. Antigonus had Pamphylia, Lycia, and Phrygia Major; Caſſander, Caria; Menander, Lydia; Leonatus, Phrygia on the Helleſpont.

Macedon. 117 Meleager murdered, and the empire divided.

In the mean time, not only Alexander's will, but Alexander himſelf, was ſo much neglected, that his body was allowed to remain ſeven days before any notice was taken of it, or any orders given for its being enbalmed. The only will he left was a ſhort memorandum of ſix things he would have done.—1. The building of a fleet of 1000 ſtout galleys, to be made uſe of againſt the Carthaginians and other nations who ſhould oppoſe the reduction of the ſea-coaſts of Africa and Spain, with all the adjacent iſlands as far as Sicily. 2. A large and regular highway was to be made along the coaſt of Africa, as far as Ceuta and Tangier. 3. Six temples of extraordinary magnificence were to be erected at the expence of 1500 talents each. 4. Caſtles, arſenals, havens, and yards for building ſhips, to be ſettled in proper places throughout his empire. 5. Several new cities were to be built in Europe and Aſia; thoſe in Aſia to be inhabited by colonies from Europe, and thoſe in Europe to be filled with Aſiatics; that, by blending their people and their manners, that hereditary antipathy might be eradicated which had hitherto ſubſiſted between the inhabitants of the different continents. 6. Laſtly, he had projected the building of a pyramid, equal in bulk and beauty to the biggeſt in Egypt, in honour of his father Philip. All theſe deſigns, under pretence of their being expenſive, were referred to a council of Macedonians, to be held nobody knew when or where.

118 Alexander's body neglected, and his will ſet aſide.

The government, being now in the hands of Perdiccas and Roxana, grew quickly very cruel and diſtaſteful. Alexander was ſcarce dead when the queen ſent for Statira and Drypetis, the two daughters of Darius, one of whom had been married to Alexander and the other to Hephæſtion; but as ſoon as they arrived at Babylon, cauſed them both to be murdered, that no ſon of Alexander by any other woman, or of Hephæſtion, might give any trouble to her or her ſon

119 The daughters of Darius put to death by Roxana.

Macedon.

Alexander. Syſigambis, the mother of Darius, no ſooner heard that Alexander the Great was dead, than ſhe laid violent hands on herſelf, being apprehenſive of the calamities which were about to enſue.

120 The Greeks revolt, but are ſubdued.

War was firſt declared in Greece againſt Antipater in the year 321 B. C. Through the treachery of the Theſſalians, that general was defeated, with the army he had under his own command. Leonatus was therefore ſent from Aſia, with a very conſiderable army, to his aſſiſtance; but both were overthrown with great loſs by the confederates, and Leonatus himſelf was killed. In a ſhort time, however, Craterus arrived in Greece with a great army, the command of which he reſigned to Antipater. The army of the confederates amounted to 25,000 foot and 3000 horſe; but Antipater commanded no fewer than 40,000 foot, 3000 archers, and 5000 horſe. In ſuch an unequal conteſt, therefore, the Greeks were defeated, and forced to ſue for peace; which they did not obtain but on condition of their receiving Macedonian garriſons into ſeveral of their cities. At Athens alſo the democratic government was abrogated; and ſuch a dreadful puniſhment did this ſeem to the Athenians, that 22,000 of them left their country, and retired into Macedon.

121 Diſturbances in Aſia and Thrace.

While theſe things were doing in Greece, diſturbances began alſo to ariſe in Aſia and in Thrace. The Greek mercenaries, who were diſperſed through the inland provinces of Aſia, deſpairing of ever being allowed to return home by fair means, determined to attempt it by force. For this purpoſe, they aſſembled to the number of 20,000 foot and 3000 horſe; but were all cut off to a man by the Macedonians. In Thrace, Lyſimachus was attacked by one Seuthes, a prince of that country who claimed the dominions of his anceſtors, and had raiſed an army of 20,000 foot and 8000 horſe. But though the Macedonian commander was forced to engage this army with no more than 4000 foot and 2000 horſe, yet he kept the field of battle, and could not be driven out of the country. Perdiccas, in the mean time, by pretending friendſhip to the royal family, had gained over Eumenes entirely to his intereſt; and at laſt put him in poſſeſſion of the province of Cappadocia by the defeat of Ariarathes king of that country, whom he afterwards cruelly cauſed to be crucified. His ambition, however, now began to lead him into difficulties. At the firſt diviſion of the provinces, Perdiccas, to ſtrengthen his own authority, had propoſed to marry Nicæa the daughter of Antipater; and ſo well was this propoſal reliſhed, that her brethren Jollas and Archias conducted her to him, in order to be preſent at the celebration of the nuptials. But Perdiccas now had other things in view. He had been ſolicited by Olympias to marry her daughter Cleopatra, the widow of Alexander king of Epirus, and who then reſided at Sardis in Lydia. Eumenes promoted this match to the utmoſt of his power, becauſe he thought it would be for the intereſt of the royal family; and his perſuaſions had ſuch an effect on Perdiccas, that he was ſent to Sardis to compliment Cleopatra, and to carry preſents to her in name of her new lover. In the abſence of Eumenes, however, Alcetas, the brother of Perdiccas, perſuaded him to marry Nicæa; but, in order to gratify his ambition, he reſolved to divorce her immediately after marriage, and marry Cleopatra. By this laſt marriage, he hoped to have a pretence for altering the government of Macedon; and, as a neceſſary meaſure preparative to theſe, he entered into contrivances for deſtroying Antigonus. Unfortanately for himſelf, however, he ruined all his ſchemes by his own jealouſy and precipitate cruelty. Cynane, the daughter of Philip by his ſecond wife, had brought her daughter named *Adda*, and who was afterwards named *Eurydice*, to court, in hopes that king Aridæus might marry her. Againſt Cynane, Perdiccas, on ſome political motives, conceived ſuch a grudge, that he cauſed her to be murdered. This raiſed a commotion in the army; which frightened Perdiccas to ſuch a degree, that he now promoted the match between Aridæus and Eurydice; to prevent which, he had murdered the mother of the young princeſs. But, in the mean time, Antigonus, knowing the deſigns of Perdiccas againſt himſelf, fled with his ſon Demetrius to Greece, there to take ſhelter under the protection of Antipater and Craterus, whom he informed of the ambition and cruelty of the regent.

Macedon.

122 Ambition and cruelty of Perdiccas.

123 A combination againſt him.

A civil war was now kindled. Antipater, Craterus, Neoptolemus, and Antigonus, were combined againſt Perdiccas; and it was the misfortune of the empire in general, that Eumenes, the moſt able general, as well as the moſt virtuous of all the commanders, was on the ſide of Perdiccas, becauſe he believed him to be in the intereſt of Alexander's family. Ptolemy, in the mean time, remained in quiet poſſeſſion of Egypt; but without the leaſt intention of owning any perſon for his ſuperior: however, he alſo acceded to the league formed againſt Perdiccas; and thus the only perſon in the whole empire who conſulted the intereſt of the royal family was Eumenes.

124 Alexander buried in Egypt.

It was now thought proper to bury the body of Alexander, which had been kept for two years, during all which time preparations had been making for it. Aridæus, to whoſe care it was committed, ſet out from Babylon for Damaſcus, in order to carry the king's body to Egypt. This was ſore againſt the will of Perdiccas; for it ſeems there was a ſuperſtitious report, that wherever the body of Alexander was laid, that country ſhould flouriſh moſt. Perdiccas, therefore, out of regard to his native ſoil, would have it conveyed to the royal ſepulchres in Macedon; but Aridæus, pleading the late king's expreſs direction, was determined to carry it into Egypt, from thence to be conveyed to the temple of Jupiter Ammon. —The funeral was accordingly conducted with all imaginable magnificence. Ptolemy came to meet the body as far as Syria: but, inſtead of burying it in the temple of Jupiter Ammon, erected a ſtately temple for it in the city of Alexandria; and, by the reſpect he ſhowed for his dead maſter, induced many of the Macedonian veterans to join him, and who were afterwards of the greateſt ſervice to him.

125 Perdiccas killed by his own men.

No ſooner was the funeral over, than both the parties above mentioned fell to blows. Perdiccas marched againſt Ptolemy; but was ſlain by his own men, who, after the death of their general, ſubmitted to his antagoniſt; and thus Eumenes was left alone to contend againſt all the other generals who had ſerved under Alexander. In this conteſt, however, he would by no means have been overmatched, had his ſoldiers

Macedon. been attached to him; but as they had been accuſtomed to ſerve under thoſe very generals againſt whom they were now to fight, they were on all occaſions ready to betray and deſert Eumenes. However, he defeated and killed Neoptolemus and Craterus, but then found himſelf obliged to contend with Antipater and Antigonus. Antipater was now appointed protector of the kings, with ſovereign power; and Eumenes was declared a public enemy. A new diviſion of Alexander's empire took place. Egypt, Libya, and the parts adjacent, were given to Ptolemy becauſe they could not be taken from him. Syria was confirmed to Leomedon. Philoxenus had Cilicia. Meſopotamia and Arbelitis were given to Amphimachus. Babylon was beſtowed on Seleucus. Suſiana fell to Antigenes, who commanded the Macedonian *Argyraſpidæ* or *Silver Shields*, becauſe he was the firſt who oppoſed Perdiccas. Peuceſtas held Perſia. Tlepolemus had Caramania. Pithon had Media as far as the Caſpian ſtraits. Staſander had Aria and Drangia. Philip, Parthia. Staſonor, Bactria and Sogdia. Sybirtius, Aracopa. Oxyartes, the father of Roxana, Parapomiſis. Another Pithon had the country between this province and India. Porus and Taxiles held what Alexander had given them, becauſe they would not part with any of their dominions. Cappadocia was aſſigned to Nicanor. Phrygia Major, Lycaonia, Pamphylia, and Lycia, were given to Antigonus. Caria to Caſſander, Lydia to Clytus, Phrygia the Leſs to Aridæus. Caſſander was appointed general of the horſe; while the command of the houſehold troops was given to Antigonus, with orders to proſecute the war againſt Eumenes.—Antipater having thus ſettled every thing as well as he could, returned to Macedon with the two kings, to the great joy of his countrymen, having left his ſon Caſſander to be a check upon Antigonus in Aſia.

126 A new diviſion of the empire

Matters now ſeemed to wear a better aſpect than they had yet done; and, had Eumenes believed that his enemies really conſulted the intereſt of Alexander's family, there is not the leaſt doubt that the war would have been immediately terminated. He ſaw, however, that the deſign of Antigonus was only to ſet up for himſelf, and therefore he refuſed to ſubmit. From this time, therefore, the Macedonian empire ceaſed in Aſia; and an account of the tranſactions of this part of the world fall to be recorded under the article SYRIA. The Macedonian affairs are now entirely confined to the kingdom of Macedon itſelf, and to Greece.

127 Total deſtruction of Alexander's family.

Antipater had not long been returned to Macedon, when he died; and the laſt action of his life completed the ruin of Alexander's family. Out of a view to the public good, he had appointed Polyſperchon, the eldeſt of Alexander's captains at hand, to be *protector* and *governor* of Macedon. This failed not to diſguſt his ſon Caſſander; who thought he had a natural right to theſe offices, and of courſe kindled a new civil war in Macedon. This was indeed highly promoted by his firſt actions as a governor. He began with attempting to remove all the governors appointed in Greece by Antipater, and to reſtore democracy wherever it had been aboliſhed. The immediate conſequence of this was, that the people refuſed to obey their magiſtrates; the governors refuſed to reſign their places, and applied for aſſiſtance to Caſſander. Polyſperchon alſo had the imprudence to recal Olympias from Epirus, and allow her a ſhare in the adminiſtration; which Antipater, and even Alexander himſelf, had always refuſed her. The conſequence of all this was, that Caſſander invaded Greece, where he prevailed againſt Polyſperchon: Olympias returned to Macedon, where ſhe cruelly murdered Aridæus and his wife Eurydice; ſhe herſelf was put to death by Caſſander, who afterwards cauſed Roxana and her ſon to be murdered, and Polyſperchon being driven into Etolia, firſt raiſed to the crown Hercules the ſon of Alexander by the daughter of Darius, and then by the inſtigation of Caſſander murdered him, by which means the line of Alexander the Great became totally extinct. Macedon.

128 Various revolutions in the government.

Caſſander having thus deſtroyed all the royal family, aſſumed the regal title, as he had for 16 years before had all the power. He enjoyed the title of *king of Macedon* only three years; after which he died, about 298 B. C. By Theſſalonica, the daughter of Philip king of Macedon, he left three ſons, Philip, Antipater, and Alexander. Philip ſucceeded him, but ſoon after died of a conſumption. A conteſt immediately began between the two brothers, Antipater and Alexander. Antipater ſeized the kingdom; and to ſecure himſelf in it, murdered his mother Theſſalonica, if not with his own hand, at leaſt the execrable fact was committed in his preſence. Alexander invited Pyrrhus king of Epirus, and Demetrius the ſon of Antigonus, to aſſiſt him and revenge the death of his mother. But Pyrrhus being bought off, and a peace concluded between the brothers, Alexander, being afraid of having too many protectors, formed a ſcheme of getting Demetrius aſſaſſinated. Inſtead of this, however, both he and Antipater were put to death; and Demetrius became king of Macedon four years after the death of Caſſander.

In 287 B. C. Demetrius was driven out by Pyrrhus, who was again driven out by Lyſimachus two years after, who was ſoon after killed by Seleucus Nicator; and Seleucus, in his turn, was murdered by Ptolemy Ceranus, who became king of Macedon about 280 B. C. The new king was in a ſhort time cut off, with his whole army, by the Gauls; and Antigonus Gonatus, the ſon of Demetrius Poliorcetes, became king of Macedon in 278 B. C. He proved ſucceſsful againſt the Gauls, but was driven out by Pyrrhus king of Epirus; who, however, ſoon diſobliged his ſubjects to ſuch a degree, that Antigonus recovered a great part of his kingdom. But in a little time, Pyrrhus being killed at the ſiege of Argos in Greece, Antigonus was reſtored to the whole of Macedon; but ſcarcely was he ſeated on the throne, when he was driven from it by Alexander the ſon of Pyrrhus. This new invader was, in his turn, expelled by Demetrius the ſon of Antigonus; who, though at that time but a boy, had almoſt made himſelf maſter of Epirus. In this enterpriſe, however, he was diſappointed; but by his means Antigonus was reſtored to his kingdom, which he governed for many years in peace. By a ſtratagem he made himſelf maſter of the city of Corinth, and from that time began to form ſchemes for the thorough conqueſt of Greece. The method he took to accompliſh this was, to ſupport the petty tyrants of Greece againſt the free ſtates: which indeed weakened the power of

Macedon. the latter; but involved the whole country in ſo many calamities, that theſe tranſactions could not redound much to the reputation either of his arms or his honour. About 243 B. C. he died, leaving the kingdom to his ſon, Demetrius II.

129 War with the Romans.

Neither Demetrius, nor his ſucceſſor Antigonus Doſon, performed any thing remarkable. In 221 B. C. the kingdom fell to Philip, the laſt but one of the Macedonian monarchs. To him Hannibal applied for aſſiſtance after the battle of Cannæ, which he refuſed; and the ſame imprudence which made him refuſe this aſſiſtance prompted him to embroil himſelf with the Romans; and at laſt to conclude a treaty with them, by which he in effect became their ſubject, being tied up from making peace or war but according to their pleaſure. In 179 B. C. he was ſucceeded by his eldeſt ſon Perſes, under whom the war with the Romans was renewed. Even yet the Macedonians were terrible in war; and their phalanx, when properly conducted, ſeems to have been abſolutely invincible by any method of making war known at that time. It conſiſted of 16,000 men, of whom 1000 marched abreaſt, and thus was 16 men deep, each of whom carried a kind of pike 23 feet long. The ſoldiers ſtood ſo cloſe, that the pikes of the fifth rank reached their points beyond the front of the battle. The hindermoſt ranks leaned their pikes on the ſhoulders of thoſe who went before them, and, locking them faſt, preſſed briſkly againſt them when they made the charge; ſo that the firſt five ranks had the impetus of the whole phalanx, which was the reaſon why the ſhock was generally irreſiſtible. The Romans had never encountered ſuch a terrible enemy; and in the firſt battle, which happened 171 B. C. they were defeated with the loſs of 2200 men, while the Macedonians loſt no more than 60. The generals of Perſes now preſſed him to ſtorm the enemy's camp; but he being naturally of a cowardly diſpoſition refuſed to comply, and thus the beſt opportunity he ever had was loſt. Still, however, the Romans gained little or no advantage, till the year 168 B. C. when Paulus Æmilius, a moſt experienced commander, was ſent into Macedon. Perſes now put all upon the iſſue of a general engagement; and Æmilius, with all his courage and military experience, would have been defeated, had the Macedonians been commanded by a general of the ſmalleſt courage or conduct. The light armed Macedonians charged with ſuch vigour, that after the battle, ſome of their bodies were found within two furlongs of the Roman camp. When the phalanx came to charge, the points of their ſpears ſtriking into the Roman ſhields, kept the heavy armed troops from making any motion; while, on the other hand, Perſes's light-armed men did terrible execution. On this occaſion, it is ſaid, that Æmilius tore his clothes, and gave up all hopes. However, perceiving that as the phalanx gained ground it loſt its order in ſeveral places, he cauſed his own light-armed troops to charge in thoſe places, whereby the Macedonians were ſoon put into confuſion. If Perſes with his horſe had on the firſt appearance of this charged the Romans briſkly, his infantry would have been able to recover themſelves; but inſtead of this, he betook himſelf to flight, and the infantry at laſt did the ſame, but not till 20,000 of them had loſt their lives.

This battle decided the fate of Macedonia, which immediately ſubmitted to the conqueror. The cowardly king took refuge in the iſland of Samothrace; but was at laſt obliged to ſurrender to the Roman conſul, by whom he was carried to Rome, led in triumph, and afterwards moſt barbarouſly uſed. Some pretenders to the throne appeared afterwards; but being unable to defend themſelves againſt the Romans, the country was reduced to a Roman province in 148 B. C. To them it continued ſubject till the year 1357, when it was reduced by the Turkiſh ſultan Bajazet, and hath remained in the hands of the Turks ever ſince.

Macedonians ‖ Machærus.

130 Macedonia becomes a Roman province.

MACEDONIANS, in eccleſiaſtical hiſtory, the followers of Macedonius, biſhop of Conſtantinople, who, through the influence of the Eunomians, was depoſed by the council of Conſtantinople in 360, and ſent into exile. He conſidered the Holy Ghoſt as a divine energy diffuſed throughout the univerſe, and not as a perſon diſtinct from the Father and the Son. The ſect of Macedonians was cruſhed before it had arrived at its full maturity, by the council aſſembled by Theodoſius in 381, at Conſtantinople. See SEMIARIANS.

MACEDONIUS. See MACEDONIANS.

MACER (EMILIUS), an ancient Latin poet, was born at Verona, and flouriſhed under Auguſtus Cæſar. Euſebius relates, that he died a few years after Virgil. Ovid ſpeaks of a poem of his, on the nature and quality of birds, ſerpents, and herbs; which he ſays Macer being then very old had often read to him:

Sæpe ſuas volucres legit mihi grandior ævo,
Quæque nocet ſerpens, quæ juvat herba, Macer.
De Ponto, lib. iv. *eleg.* 10.

There is extant a poem upon the nature and power of herbs under Macer's name; but it is ſpurious. He alſo wrote a ſupplement to Homer, as Quintus Calaber did afterwards in Greek:

Tu canis æterno quicquid reſtabat Homero:
Ne careant ſumma Troica bella manu.
De Ponto, lib. ii. *eleg.* 10.

MACERATION, is an infuſion of, or ſoaking ingredients in water or any other fluid, in order either to ſoften them or draw out their virtues.

MACERATA, a handſome and populous town of Italy, in the territory of the church, and in the Marche of Ancona, with a biſhop's ſee, and an univerſity. It is ſeated near the mountain Chiento, in E. Long. 13. 37. N. Lat. 43. 15.

MACHAON, a celebrated phyſician among the ancients, ſon of Æſculapius and brother to Podalirus. He went to the Trojan war with the inhabitants of Trica, Ithome, and Œchalia. According to ſome, he was king of Meſſenia. He was phyſician to the Greeks, and healed the wounds which they received during the Trojan war. Some ſuppoſe he was killed before Troy by Eurypylus the ſon of Telephus. He received divine honours after death, and had a temple in Meſſenia.

MACHÆRUS (anc. geog.), a citadel on the other ſide Jordan, near the mountains of Moab, not far from and to the north of the *Lacus Aſphaltites*. It was the ſouth boundary of the Peræa: ſituated on a mountain encompaſſed round with deep and broad valleys; built by Alexander king of the Jews, deſtroyed by Gabinius in the war with Ariſtobulus, and rebuilt by Herod with a cognominal town round it. Here John the Baptiſt was beheaded (Joſephus).

MACHIAN,

Machian || Machines.

MACHIAN, one of the Molucca iſlands, in the Eaſt Indian Ocean, about 20 miles in circumference, and the moſt fertile of them all. It likewiſe produces the beſt cloves; and is in poſſeſſion of the Dutch, who have three ſtrong forts built on it.

MACHIAVEL (Nicholas), a famous political writer of the 16th century, was born of a diſtinguiſhed family at Florence. He wrote in his native language with great elegance and politeneſs, though he underſtood very little of the Latin tongue; but he was in the ſervice of Marcellus Virgilius, a learned man, who pointed out to him many of the beautiful paſſages in the ancients, which Machiavel had the art of placing properly in his works. He compoſed a comedy upon the ancient Greek model; in which he turned into ridicule many of the Florentine ladies, and which was ſo well received, that Pope Leo X. cauſed it to be acted at Rome. Machiavel was ſecretary, and afterwards hiſtoriographer, to the republic of Florence. The houſe of Medicis procured him this laſt office, together with a handſome ſalary, in order to pacify his reſentment for having ſuffered the torture upon ſuſpicion of being an accomplice in the conſpiracy of the Soderini againſt that houſe, when Machiavel bore his ſufferings without making any confeſſion. The great encomiums he beſtowed upon Brutus and Caſſius, both in his converſations and writings, made him ſtrongly ſuſpected of being concerned in another conſpiracy againſt cardinal Julian de Medicis, who was afterwards pope under the name of *Clement VII.* However, they carried on no proceedings againſt him; but from that time he turned every thing into ridicule, and gave himſelf up to irreligion. He died in 1530, of a remedy which he had taken by way of prevention.—Of all his writings, that which has made the moſt noiſe, and has drawn upon him the moſt enemies, is a political treatiſe entitled the *Prince;* which has been tranſlated into ſeveral languages, and wrote againſt by many authors. The world is not agreed as to the motives of this work; ſome thinking, he meant to recommend tyrannical maxims; others, that he only delineated them to excite abhorrence. Machiavel alſo wrote, Reflections on Titus Livius, which are extremely curious; The Hiſtory of Florence, from the year 1205 to 1494; and a quarto volume of Poems and other pieces. Mr Harrington conſiders him as a ſuperior genius, and as the moſt excellent writer on politics and government that ever appeared.

MACHINE, (*Machina*), in the general, ſignifies any thing that ſerves to augment or to regulate moving powers: Or it is any body deſtined to produce motion, ſo as to ſave either time or force. The word comes from the Greek μαχανη, "machine, invention, art:" And hence, in ſtrictneſs, a machine is ſomething that conſiſts more in art and invention, than in the ſtrength and ſolidity of the materials; for which reaſon it is that the inventors of machines are called *ingenieurs* or *engineers*.

Machines are either ſimple or compound. The ſimple ones are the ſeven mechanical powers, viz. lever, ballance, pully, axis and wheel, wedge, ſcrew, and inclined plane. See MECHANICS.

From theſe the compound ones are formed by various combinations, and ſerve for different purpoſes. See MECHANICS and HYDROSTATICS; alſo the articles AGRICULTURE, CANNON, CENTRIFUGAL, FIRE, STEAM, FURNACE, BURROUGHS, RAMSDEN, &c. &c. Machinery || Mchynleth.

MACHINES uſed in war amongſt the Greeks, were principally theſe: 1. Κλιμακες, or ſcaling ladders; 2. The battering ram; 3. The *helepolis;* 4. The χελωνη or tortoiſe, called by the Romans *teſtudo;* 5. The χωμα or *agger*, which was faced with ſtone, and raiſed higher than the wall; 6. Upon the χωμα were built πυργοι or towers of wood; 7. Γερραι, or oſier hurdles; 8. *Catapultæ*, or καταπελται, from which they threw arrows with amazing force; and, 9. The λιθοβολοι, πετροβολοι, or αφεηρια, from which ſtones were caſt with great velocity.

The principal warlike machines made uſe of by the Romans were, the ram, the *lupus* or wolf, the *teſtudo* or tortoiſe, the *baliſta*, the *catapulta*, and the *ſcorpion*.

MACHINERY, in epic and dramatic poetry, is when the poet introduces the uſe of machines; or brings ſome ſupernatural being upon the ſtage, in order to ſolve ſome difficulty or to perform ſome exploit out of the reach of human power.

The ancient dramatic poets never made uſe of machines, unleſs where there was an abſolute neceſſity for ſo doing: whence the precept of Horace;

Nec Deus interſit, niſi dignus vindice nodus
Inciderit.

It is quite otherwiſe with epic poets, who introduce machines in every part of their poems; ſo that nothing is done without the intervention of the gods. In Milton's Paradiſe Loſt, by far the greater part of the actors are ſupernatural perſonages: Homer and Virgil do nothing without them; and, in Voltaire's Henriade, the poet has made excellent uſe of St Louis.

As to the manner in which theſe machines ſhould act, it is ſometimes inviſibly, by ſimple inſpirations and ſuggeſtions; ſometimes by actually appearing under ſome human form; and, laſtly, by means of dreams and oracles, which partake of the other two. However, all theſe ſhould be managed in ſuch a manner as to keep within the bounds of probability.

MACHUL, an inſtrument of muſic among the Hebrews. Kircher apprehends that the name was given to two kinds of inſtruments, one of the ſtringed and the other of the pulſatile kind. That of the former ſort had ſix chords: though there is great reaſon to doubt whether an inſtrument requiring the aid of the hair-bow, and ſo much reſembling the violin, be ſo ancient. The ſecond kind was of a circular form, made of metal, and either hung round with little bells, or furniſhed with iron rings ſuſpended on a rod or bar that paſſed acroſs the circle. Kircher ſuppoſes that it was moved to and fro by a handle fixed to it, and thus emitted a melancholy kind of murmur. Plate CCLXXIX

MACHYNLETH, a town of Montgomeryſhire in North Wales, 198 miles from London, and 32 from Montgomery. It is an ancient town; and has a market on Mondays, and fairs on May 16, June 26, July 9, September 18, and November 25, for ſheep, horned cattle, and horſes. It is ſeated on the river Douay, over which there is a large ſtone bridge, which leads into Merionethſhire. It was here that Owen Glyndwr exerciſed the firſt acts of his royalty in 1402.

Here

Mackenzie, Mackerel.

Here he accepted the crown of Wales, and aſſembled a parliament; and the houſe wherein they met is now ſtanding, divided into tenements.

MACKENZIE, (Sir George), an able lawyer, a polite ſcholar, and a celebrated wit, was born at Dundee in the county of Angus in Scotland in 1636, and ſtudied at the univerſities of Aberdeen and St Andrew's; after which he applied himſelf to the civil law, travelled into France, and proſecuted his ſtudy in that faculty for about three years. At his return to his native country, he became an advocate in the city of Edinburgh; and ſoon gained the character of an eminet pleader. He did not, however, ſuffer his abilities to be confined entirely to that province. He had a good taſte for polite literature; and he gave the public, from time to time, inconteſtable proofs of an uncommon proficiency therein. He had practiſed but a few years, when he was promoted to the office of a judge in the criminal court; and, in 1674, was made king's advocate, and one of the lords of the privy council in Scotland. He was alſo knighted by his majeſty, In theſe ſtations he met with a great deal of trouble, on account of the rebellions which happened in his time; and his office of advocate requiring him to act with ſeverity, he did not eſcape being cenſured, as if in the deaths of ſome particular perſons who were executed he had ſtretched the laws too far. But there does not ſeem to have been any juſt foundation for this clamour againſt him; and it is generally agreed, that he acquitted himſelf like an able and upright magiſtrate. Upon the abrogation of the penal laws by king James II. our advocate, though he had always been remarkable for his loyalty, and even cenſured for his zeal againſt traitors and fanatics, thought himſelf obliged to reſign his poſt; being convinced, that he could not diſcharge the duties of it in that point with a good conſcience. But he was ſoon after reſtored, and held his offices till the revolution; an event which, it ſeems, he could not bring himſelf to approve. He had hoped that the prince of Orange would have returned to his own country when matters were adjuſted between the king and his ſubjects; and upon its proving otherwiſe, he quitted all his employments in Scotland, and retired into England, reſolving to ſpend the remainder of his days in the univerſity of Oxford. He arrived there in September 1689, and proſecuted his ſtudies in the Bodleian library, being admitted a ſtudent there by a grace paſſed in the congregation, June 2. 1690. In the ſpring following, he went to London; where he fell into a diſorder, of which he died in May 1691. His corpſe was conveyed by land to Scotland, and interred there with great pomp and ſolemnity. "The politeneſs of his learning, and the ſprightlineſs of his wit, were (ſays the reverend Mr Granger) conſpicuous in all his pleadings, and ſhone in his ordinary converſation." Mr Dryden acknowledges, that he was unacquainted with what he calls the *beautiful turn of words and thoughts in poetry*, till they were explained and exemplified to him in a converſation with that noble wit of Scotland Sir George Mackenzie.—He wrote ſeveral pieces of hiſtory and antiquities; Inſtitutions of the laws of Scotland; Eſſays upon various ſubjects, &c. His works were printed together at Edinburgh in 1716, in 2 vols folio.

MACKEREL, in ichthyology. See SCOMBER.

Mackey, Maclaurin.

MACKEY (John,) an Engliſhman, employed by the government as a ſpy upon James II. after the revolution, was author of Memoirs of James's court at St Germaine, and of the court of England in the reigns of William III. and queen Anne; in which are many curious anecdotes not to be met with in any other work. He died in 1726.

MACLAURIN (Colin), a moſt eminent mathematician and philoſopher, was the ſon of a clergyman, and born at Kilmoddan in Scotland in 1698. He was ſent to the univerſity of Glaſgow in 1709; where he continued five years, and applied himſelf to ſtudy in a moſt intenſe manner. His great genius for mathematical learning diſcovered itſelf ſo early as at twelve years of age; when, having accidentally met with an Euclid in a friend's chamber, he became in a few days maſter of the firſt ſix books without any aſſiſtance: and it is certain, that in his 16th year he had invented many of the propoſitions which were afterwards publiſhed under the title of *Geometria organica*. In his 15th year he took the degree of maſter of arts; on which occaſion he compoſed and publicly defended a theſis On the power of Gravity, with great applauſe. After this he quitted the univerſity, and retired to a country-ſeat of his uncle, who had the care of his education; for his parents had been dead ſome time. Here he ſpent two or three years in purſuing his favourite ſtudies; but, in 1717, he offered himſelf a candidate for the profeſſorſhip of mathematics in the Mariſchal college of Aberdeen, and obtained it after a ten days trial with a very able competitor. In 1719, he went to London, where he became acquainted with Dr Hoadly then biſhop of Bangor, Dr Clarke, Sir Iſaac Newton, and other eminent men; at which time alſo he was admitted a member of the Royal Society: and in another journey in 1721, he contracted an intimacy with Martin Folkes, Eſq. the preſident of it, which laſted to his death.

In 1722, lord Polwarth, plenipotentiary of the king of Great-Britain at the congreſs of Cambray, engaged him to go as a tutor and companion to his eldeſt ſon, who was then to ſet out on his travels. After a ſhort ſtay at Paris, and viſiting other towns in France, they fixed in Lorrain; where Maclaurin wrote his piece On the Percuſſion of Bodies, which gained the prize of the royal academy of ſciences for the year 1724. But his pupil dying ſoon after at Montpelier, he returned immediately to his profeſſion at Aberdeen. He was hardly ſettled here, when he received an invitation to Edinburgh; the curators of that univerſity being deſirous that he ſhould ſupply the place of Mr James Gregory, whoſe great age and infirmities had rendered him incapable of teaching. He had ſome difficulties to encounter, ariſing from competitors, who had good intereſt with the patrons of the univerſity, and alſo from the want of an additional fund for the new profeſſor; which however at length were all ſurmounted, principally by the means of Sir Iſaac Newton. In Nov. 1725, he was introduced into the univerſity; as was at the ſame time his learned colleague and intimate friend, Dr Alexander Monro, profeſſor of anatomy. After this, the mathematical claſſes ſoon became very numerous, there being generally upwards of 100 young gentlemen attending his lectures every year; who being of different ſtandings and proficiency, he

was

Maclaurin

was obliged to divide them into four or five claſſes, in each of which he employed a full hour every day, from the firſt of November to the firſt of June.

He lived a bachelor to the year 1733: but being not leſs formed for ſociety than for contemplation, he then married Anne, the daughter of Mr Walter Stewart ſolicitor-general to his late majeſty for Scotland. By this lady he had ſeven children, of whom two ſons and three daughters, together with his wife, ſurvived him. In 1734, Berkeley, biſhop of Cloyne, publiſhed a piece called "The Analyſt;" in which he took occaſion, from ſome diſputes that had ariſen concerning the grounds of the fluxionary method, to explode the method itſelf, and alſo to charge mathematicians in general with infidelity in religion. Maclaurin thought himſelf included in this charge, and began an anſwer to Berkeley's book: but, as he proceeded, ſo many diſcoveries, ſo many new theories and problems occurred to him, that inſtead of a vindicatory pamphlet, his work came out, A complete ſyſtem of Fluxions, with their application to the moſt conſiderable problems in geometry and natural philoſophy. This work was publiſhed at Edinburgh in 1742, 2 vols 4to; and as it coſt him infinite pains, ſo it is the moſt conſiderable of all his works, and will do him immortal honour. In the mean time, he was continually obliging the public with ſome performance or obſervation of his own; many of which were publiſhed in the fifth and ſixth volumes of the "Medical Eſſays" at Edinburgh. Some of them were likewiſe publiſhed in the Philoſophical Tranſactions; as the following: 1. Of the conſtruction and meaſure of curves, N° 356. 2. A new method of deſcribing all kinds of curves, N° 359. 3. A letter to Martin Folkes, Eſq; on equations with impoſſible roots, May 1726, N° 394. 4. Continuation of the ſame, March 1729, N° 408. 5. December the 21ſt, 1732, on the deſcription of curves; with an account of farther improvements, and a paper dated at Nancy, Nov. 27, 1722, N° 439. 6. An account of the treatiſe of fluxions, Jan. 27, 1742, N° 467. 7. The ſame continued, March 10, 1742, N° 469. 8. A rule for finding the meridional parts of a ſpheroid with the ſame exactneſs as of a ſphere, Auguſt 1741, N° 461. 9. Of the baſis of the cells wherein the bees depoſite their honey; Nov. 3. 1734. N° 471.

In the midſt of theſe ſtudies, he was always ready to lend his aſſiſtance in contriving and promoting any ſcheme which might contribute to the ſervice of his country. When the earl of Morton ſet out in 1739 for Orkney and Shetland, to viſit his eſtates there, he deſired Mr Maclaurin to aſſiſt him in ſettling the geography of thoſe countries, which is very erroneous in all our maps; to examine their natural hiſtory, to ſurvey the coaſts, and to take the meaſure of a degree of the meridian. Maclaurin's family affairs, and other connections, would not permit him to do this: he drew, however, a memorial of what he thought neceſſary to be obſerved, furniſhed the proper inſtruments, and recommended Mr Short, the famous optician, as a fit operator for the management of them. He had ſtill another ſcheme for the improvement of geography and navigation, of a more extenſive nature; which was the opening a paſſage from Greenland to the South Sea by the north pole. That ſuch a paſſage might be found, he was ſo fully perſuaded, that he has been heard to ſay, if his ſituation could admit of ſuch adventures, he would undertake the voyage, even at his own charge. But when ſchemes for finding it were laid before the parliament in 1744, and himſelf conſulted by ſeveral perſons of high rank concerning them, before he could finiſh the memorials he propoſed to ſend, the premium was limited to the diſcovery of a North-weſt paſſage: and he uſed to regret, that the word Weſt was inſerted, becauſe he thought that paſſage, if at all to be found, muſt lie not far from the pole. Maclaurin.

In 1745, having been very active in fortifying the city of Edinburgh againſt the rebel army, he was obliged to fly from thence to the north of England; where he was invited by Herring, then archbiſhop of York, to reſide with him during his ſtay in this country. In this expedition, however, being expoſed to cold and hardſhips, and naturally of a weak and tender conſtitution, he laid the foundation of an illneſs which put an end to his life, in June 1746, at the age of 48.

Mr Maclaurin was a very good as well as a very great man, and worthy of love as well as admiration. His peculiar merit as a philoſopher was, that all his ſtudies were accommodated to general utility; and we find, in many places of his works, an application even of the moſt abſtruſe theories, to the perfecting of mechanical arts. He had reſolved, for the ſame purpoſe, to compoſe a courſe of practical mathematics, and to reſcue ſeveral uſeful branches of the ſcience from the bad treatment they often met with in leſs ſkilful hands. But all this his death prevented; unleſs we ſhould reckon, as a part of his intended work, the tranſlation of Dr David Gregory's "Practical Geometry," which he reviſed, and publiſhed with additions, 1745. In his lifetime, however, he had frequent opportunities of ſerving his friends and his country by his great ſkill. Whatever difficulty occurred concerning the conſtructing or perfecting of machines, the working of mines, the improving of manufactures, the conveying of water, or the execution of any other public work, he was at hand to reſolve it. He was likewiſe employed to terminate ſome diſputes of conſequence that had ariſen at Glaſgow concerning the gauging of veſſels; and for that purpoſe preſented to the commiſſioners of exciſe two elaborate memorials, with their demonſtrations, containing rules by which the officers now act. He made alſo calculations relating to the proviſion, now eſtabliſhed by law, for the children and widows of the Scots clergy, and of the profeſſors in the univerſities, intitling them to certain annuities and ſums, upon the voluntary annual payment of a certain ſum by the incumbent. In contriving and adjuſting this wiſe and uſeful ſcheme, he beſtowed a great deal of labour, and contributed not a little towards bringing it to perfection. It may be ſaid of ſuch a man, that "he lived to ſome purpoſe;" which can hardly be ſaid of thoſe, how uncommon ſoever their abilities and attainments, who ſpend their whole time in abſtract ſpeculations, and produce nothing to the real uſe and ſervice of their fellow creatures.

Of his works, we have mentioned his *Geometria Organica*, in which he treats of the deſcription of curve lines by continued motion. We need not repeat what has

Mackenzie, Macquer.

has been ſaid concerning his piece which gained the prize of the royal academy of ſciences in 1724. In 1740, the academy adjudged him a prize, which did him ſtill more honour, for ſolving the motion of the tides from the theory of gravity; a queſtion which had been given out the former year, without receiving any ſolution. He had only ten days to draw this paper up in, and could not find leiſure to tranſcribe a fair copy; ſo that the Paris edition of it is incorrect. He afterwards reviſed the whole, and inſerted it in his Treatiſe of Fluxions; as he did alſo the ſubſtance of the former piece. Theſe, with the Treatiſe of Fluxions, and the pieces printed in the Philoſophical Tranſactions, of which we have given a liſt, are all the writings which our author lived to publiſh. Since his death, two volumes more have appeared; his Algebra, and his Account of Sir Iſaac Newton's Philoſophical Diſcoveries. His Algebra, though not finiſhed by himſelf, is yet allowed to be excellent in its kind; containing, in no large volume, a complete elementary treatiſe of that ſcience, as far as it has hitherto been carried. His Account of Sir Iſaac Newton's Philoſophy was occaſioned in the following manner: Sir Iſaac dying in the beginning of 1728, his nephew, Mr Conduitt, propoſed to publiſh an account of his life, and deſired Mr Maclaurin's aſſiſtance. The latter, out of gratitude to his great benefactor, cheerfully undertook, and ſoon finiſhed, the hiſtory of the progreſs which philoſophy had made before Sir Iſaac's time, and this was the firſt draught of the work in hand; which not going forward, on account of Mr Conduitt's death, was returned to Mr Maclaurin.—To this he afterwards made great additions, and left it in the ſtate in which it now appears. His main deſign ſeems to have been, to explain only thoſe parts of Sir Iſaac's philoſophy which have been, and ſtill are, controverted: and this is ſuppoſed to be the reaſon why his grand diſcoveries concerning light and colours are but tranſiently and generally touched upon. For it is known, that ever ſince the experiments, on which his doctrine of light and colours is founded, have been repeated with due care, this doctrine has not been conteſted; whereas his accounting for the celeſtial motions, and the other great appearances of nature, from gravity, is miſunderſtood, and even ridiculed by ſome to this day.

MACQUER (Philippe), advocate of the parliament of Paris, where he was born in 1720, being deſcended from a reſpectable family. A weakneſs in his lungs having prevented him from engaging in the laborious exerciſes of pleading, he dedicated himſelf to literary purſuits. His works are, 1. *L'Abregé Chronologique de l'Hiſtoire Eccleſiaſtique*, 3 vols. 8vo, written in the manner of the Preſident Henault's Hiſtory of France, but not poſſeſſed of equal ſpirit and elegance. 2. *Les Annales Romaines*, 1756, 8vo; another chronological abridgement, and much better ſupported than the former. Into this work the author has introduced every thing moſt worthy of notice which has been written by Saint Evremond, Abbé Saint-Real, Preſident Monteſquieu, Abbé Mably, &c. concerning the Romans; and, if we except a difference of ſtyle, which is eaſily diſcernible, it is, in other reſpects, a very judicious compilation. 3. *Abregé Chronologique de l'Hiſtoire d'Eſpagne & de Portugal*, 1759, 1765, in two vols. 8vo. This book, in point of accuracy, is worthy of the Preſident Henault, by whom it was begun; but it diſplays no diſcrimination of character nor depth of reſearch. The author received aſſiſtance from M. Lacombe, whoſe talents for chronological abridgement are well known. The republic of letters ſuſtained a loſs by the death of M. Macquer, which happened on the 27th of January 1770, at the age of 50. As to his character, he was induſtrious, agreeable, modeſt, and ſincere, and an enemy to all fooliſh vanity and affectation. He had a cold imagination, but a correct taſte. He had an eager thirſt for knowledge of every kind, and he had neglected no uſeful branch of ſtudy. He had a ſhare in the Dictionary of Arts and Profeſſions, in 2 vols 8vo, and in the Tranſlation of the Syphilis of Fracaſtor publiſhed by Lacombe.

Macquer || Macrobii.

MACQUER (Pierre Joſeph), brother to the former, was born at Paris the 9th of October 1718, and died there February 16th 1784. He was a member of the academy of ſciences, and late profeſſor of pharmacy; and was engaged in the *Journal des Savans*, for the articles of medicine and chemiſtry. With the latter ſcience he was intimately acquainted. He had a ſhare in the *Pharmacopœia Pariſienſis*, publiſhed in 1758, in 4to. His other works are, 1. *Elemens de Chimie theorique;* Paris, 1749, 1753, 12mo; which have been tranſlated into Engliſh and German.—2. *Elemens de Chimie pratique*, 1751, 2 vols. 12mo. Theſe two works were re-publiſhed together, in 1756, in 3 vols 12mo. 3. *Plan d'un cours de Chimie experimentale & raiſonée*, 1757, 12mo; in the compoſition of which he was aſſociated with M. Beaumé. 4. *Formulæ Medicamentorum Magiſtralium*, 1763. 5. *L'Art de la Teinture en Soie*, 1763—6. *Dictionnaire de Chemie, contenant la théorie & la pratique de cet art*, 1766, 2 vols 8vo; which has been tranſlated into German, with notes; and into Engliſh, with notes, by Mr Keir. Macquer has, by his labours and writings, greatly contributed to render uſeful an art which formerly tended only to ruin the health of the patient by foreign remedies, or to reduce the profeſſors of it to beggary, while they proſecuted the idle dreams of converting every thing into gold.

MACRIN (Salmon), one of the beſt Latin poets of the 16th century, was born at Loudon. His true name was *John Salmon*; but he took that of *Macrin*, from his being frequently ſo called in ridicule by Francis I. on account of his extraordinary leanneſs. He was preceptor to Claudius of Savoy, count of Tende; and to Honorius the count's brother; and wrote ſeveral pieces of poetry in lyric verſe, which were ſo admired, that he was called *the Horace of his time*. He died of old age, at Loudon, in 1555.—*Charles* MACRIN, his ſon, was not inferior to him as a poet, and ſurpaſſed him in his knowledge of the Greek tongue. He was preceptor to Catharine of Navarre, the ſiſter of Henry the Great; and periſhed in the maſſacre on St Bartholomew's day in 1572.

MACROBII, a people of Ethiopia, celebrated for their juſtice, and the innocence of their manners: alſo a people in the iſland Meröe. The Hyperboreans were alſo called Macrobii: They generally lived to their 120th year; and from their longevity they obtained their name (μακρος βιος, *long life.*)

Macrobius, Macrocephalus.

MACROBIUS (Ambroſius Aurelius Theodoſius), an ancient Latin writer, who flouriſhed towards the latter part of the fourth century.—Of what country he was, is not clear: Eraſmus, in his Ciceronianus, ſeems to think he was a Greek; and he himſelf tells us, in the preface to his Saturnalia, that he was not a Roman, but laboured under the inconveniences of writing in a language which was not natural to him. Of what religion he was, Chriſtian or Pagan, is uncertain. Barthius ranks him among the Chriſtians; but Spanheim and Fabricius ſuppoſe him to have been a heathen. This, however, is certain, that he was a man of conſular dignity, and one of the chamberlains or maſters of the wardrobe to Theodoſius; as appears from a reſcript directed to Florentius, concerning thoſe who were to obtain that office. He wrote a Commentary upon Cicero's *Somnium Scipionis*, and ſeven books of *Saturnalia*, which treat of various ſubjects, and are an agreeable mixture of criticiſm and antiquity. He was not an original writer, but made great uſe of other people's works, borrowing not only their materials, but even their language, and for this he has been ſatirically rallied by ſome modern authors, though rather unfairly, conſidering the expreſs declaration and apology which he makes on this head, at the very entrance of his work. "Don't blame me," ſays he, "if what I have collected from multifarious reading, I ſhall frequently expreſs in the very words of the authors from whom I have taken it: for my view in this preſent work is, not to give proofs of my eloquence, but to collect and digeſt into ſome regularity and order ſuch things as I thought might be uſeful to be known. I ſhall therefore here imitate the bees, who ſuck the beſt juices from all ſorts of flowers, and afterwards work them up into various forms and orders, with ſome mixture of their own proper ſpirit." The *Somnium Scipionis* and *Saturnalia* have been often printed; to which has been added, in the later editions, a piece intituled, *De Differentiis & Societatibus Græci Latinique Verbi*.

MACROCEPHALUS, (compounded of μακρος "great," and κεφαλη "head," denotes a perſon with a head larger or longer than the common ſize. Macrocephali, or Long-heads, is a name given to a certain people, who, according to the accounts of authors, were famous for the unſeemly length of their heads: yet cuſtom ſo far habituated them to it, that inſtead of looking on it as a deformity, they eſteemed it a beauty, and, as ſoon as the child was born, moulded and faſhioned its head in their hands to as great a length as poſſible, and afterwards uſed all ſuch rollers and bandages as might ſeem moſt likely to determine its growing long. The greater part of the iſlanders in the Archipelago, ſome of the people of Aſia, and even ſome of thoſe of Europe, ſtill preſs their childrens heads out lengthwiſe. We may obſerve alſo, that the Epirots, many people of America, &c. are all born with ſome ſingularity in the conformation of their heads; either a flatneſs on the top, two extraordinary protuberances behind, or one on each ſide; ſingularities which we can only regard as an effect of an ancient and ſtrange mode, which at length is become hereditary in the nation. According to the report of many travellers, the operation of compreſſing the head of a child lengthwiſe, while it is yet ſoft, is with a view inſenſibly to enlarge the interval between the two eyes, ſo that the viſual rays turning more to the right and left, the ſight would embrace a much larger portion of the horizon; the advantage of which they are well acquainted with, either in the conſtant exerciſe of hunting, or on a thouſand other occaſions. Ever ſince the 16th century, the miſſionaries eſtabliſhed in the countries inhabited by the ſavages of America, have endeavoured to deſtroy this cuſtom; and we find in the ſeſſions of the third council of Lima, held in 1585, a canon which expreſsly prohibits it. But if it has been repreſſed one way, the free negroes and Maroons, although Africans, have adopted it, ſince they have been eſtabliſhed among the Caribs, ſolely with the view of diſtinguiſhing their children, which are born free, from thoſe who are born in ſlavery. The Omaquas, a people of South America, according to P. Veigh, preſs the heads of their children ſo violently between two planks that they become quite ſharp at the top, and flat before and behind. They ſay they do this to give their heads a greater reſemblance to the moon.

Macrocerci ‖ Macrotelostyla.

MACROCERCI, a name given to that claſs of animalcules which have tails longer than their bodies.

MACROCOLUM, or MACROCOLLUM (formed of μακρος "large," and κολλαω "I join,") among the Romans, the largeſt kind of paper then in uſe. It meaſured ſixteen inches, and frequently two feet.

MACROCOSM, a word denoting the great world or univerſe. It is compounded of the Greek words μακρος "great," and κοσμος "world."

MACROOMP, or MACROOM, a town of Ireland, in the barony of Muſkerry, county of Cork, and province of Munſter, 142 miles from Dublin; it is ſituated amongſt hills, in a dry gravelly limeſtone ſoil.—This place is ſaid to take its name from an old crooked oak, ſo called in Iriſh, which formerly grew here. The caſtle was firſt built in King John's time, ſoon after the Engliſh conqueſt, (according to Sir Richard Cox) by the Carews, but others attribute it to the Daltons. It was repaired and beautified by Teague Macarty, who died in the year 1565, and was father to the celebrated Sir Cormac Mac Teague mentioned by Cambden and other writers as an active perſon in Queen Elizabeth's time. The late Earls of Glancarty altered this caſtle into a more modern ſtructure, it being burnt down in the wars of 1641. Oppoſite to the bridge, is the pariſh-church, dedicated to St Colman of Cloyne. Here is a barrack for a foot company, a market-houſe, and handſome Roman Catholic chapel. A conſiderable number of perſons have been employed in this town in combing wool and ſpinning yarn, and ſome ſalt-works have been erected here. At half a mile's diſtance is a ſpa, that riſes on the very brink of a bog; its waters are a mild chalybeate, and are accounted ſerviceable in hypochondriacal caſes, and in cutaneous eruptions. The fairs are four in the year.

MACROPYRENIUM, in natural hiſtory, a genus of foſſils conſiſting of cruſtated ſeptariæ, with a long nucleus ſtanding out at each end of the maſs.

MACROTELOSTYLA, in natural hiſtory, the name of a genus of cryſtals, which are compoſed of two pyramids joined to the end of a column; both the pyramids, as alſo the column, being hexangular,

Mactatio || Madagaſcar.

and the whole body conſequently compoſed of 18 planes.

MACTATIO, in the Roman ſacrifices, ſignifies the act of killing the victim. This was performed either by the prieſt himſelf, or ſome of his inferior officers, whom we meet with under the names of *popæ*, *agones*, *cultrarii*, and *victimarii*; but, before the beaſt was killed, the prieſt, turning himſelf to the eaſt, drew a crooked line with his knife, from the forehead to the tail. Among the Greeks, this ceremony was performed moſt commonly by the prieſt, or, in his abſence, by the moſt honourable perſon preſent. If the ſacrifice was offered to the celeſtial gods, the victim's throat was bent up towards heaven; if to the infernal, or to heroes, it was killed with its throat towards the ground. The manner of killing the animal was by a ſtroke on the head, and, after it was fallen, thruſting a knife into its throat. Much notice was taken, and good or ill ſucceſs predicted, from the ſtruggles of the beaſt, or its quiet ſubmiſſion to the blow, from the flowing of the blood, and the length of time it happened to live after the fall, &c.

MACULÆ, in aſtronomy, dark ſpots appearing on the luminous ſurfaces of the ſun and moon, and even ſome of the planets. See ASTRONOMY, n° 30. and n° 58 *et ſeq.* and n° 98. and n° 121 *et ſeq.*

MAD-APPLE. See SOLANUM.

MADAGASCAR, the largeſt of the African iſlands, is ſituated between 43° and 51° of E. Long. and between 12° and 26° of S. Lat.; extending in length near 1000 miles from north-north-eaſt to ſouth-ſouth-weſt, and about 300 in breadth where broadeſt. It was diſcovered in 1506 by Laurence Almeyda; but the Perſians and the Arabians were acquainted with it from time immemorial under the name of *Serandib*. Alphonzo Albukerque ordered Ruy Pereira dy Conthinto to viſit the interior parts, and that general intruſted Triſtan d'Acunha with the ſurvey. The Portugueſe called it the iſland of *St Laurence*; the French, who viſited it in the reign of Henry IV. named it *Iſle Dauphine*; its proper name is *Madegaſſe*. It is now, however, by common conſent, called *Madagaſcar*.

This large iſland, according to many learned geographers, is the Cerné of Pliny, and the Menuthiaſde of Ptolemy. It is every where watered by large rivers, ſtreams, and rivulets, which have their ſource at the foot of that long chain of mountains which runs thro' the whole extent of the iſland from eaſt to weſt. The two higheſt promontories are called *Vivagora* and *Botiſtmene*.

• *Voyage à Madagaſcar*, &c. Par. 1791.

Theſe mountains (according to the Abbe Rochon*) incloſe within their boſoms a variety of precious minerals and uſeful foſſils. The traveller (who for the firſt time rambles over ſavage and mountainous countries, interſected with valleys and with hills, where nature left to herſelf brings forth the moſt ſingular and the moſt varied productions) is involuntarily ſurpriſed and terrified at the ſight of precipices, the ſummits of which are crowned with monſtrous trees, that ſeem coeval with the world. His aſtoniſhment is redoubled at the noiſe of thoſe grand caſcades, the approach to which is generally inacceſſible. But to thoſe views ſo ſublimely pictureſque, rural ſcenes ſoon ſucceed; little hills, gentle riſing grounds, and plains, the vegetation of which is never repreſſed by the intemperance or the viciſſitude of the ſeaſons. The eye contemplates with pleaſure thoſe vaſt ſavannas which nouriſh numberleſs herds of bullocks and of ſheep. You behold a flouriſhing agriculture, produced almoſt ſolely by the fertiliſing womb of nature. The fortunate inhabitants of Madagaſcar do not bedew the earth with their ſweat; they ſcarce ſtir the ground with a rake, and even that ſlight preparation is ſufficient. They ſcrape little holes at a ſmall diſtance from each other, into which they ſcatter a few grains of rice, and cover them with their feet; and ſo great in the fertility of the ſoil, that the lands ſown in this careleſs manner produce an hundred fold. Madagaſcar.

The foreſts preſent a prodigious variety of the moſt uſeful and the moſt beautiful trees; ebony, wood for dying, bamboos of an enormous thickneſs, and palm trees of every kind. The timber employed in ſhip-building is no leſs common than thoſe kinds ſo much prized by the cabinet-maker. We are told by the French governor Flacourt, in his hiſtory of this iſland †, that in the year 1650 he ſent to France 52,000 weight of aloes of an excellent quality. All of theſe various trees and ſhrubs are ſurrounded by an infinite number of paraſitical plants: muſhrooms of an infinite diverſity of kinds and colours are to be met with every where in the woods; and the inhabitants know well how to diſtinguiſh thoſe which are prejudicial to the health. They collect large quantities of uſeful gums and reſins; and out of the milky ſap of a tree, denominated by them *finguiore*, the inhabitants, by means of coagulation, make that ſingular ſubſtance known to naturaliſts by the name of *gum elaſtic*. (See CAOUTCHOUC and JATROPHA.)

† *Hiſt. de la Grand Iſle de Madagr.* Paris 1660.

Beſides the aromatic and medicinal herbs which abound in the foreſts, the iſland produces flax and hemp of a length and ſtrength which ſurpaſs any in Europe. Sugar canes, wax, honey of different kinds, tobacco, indigo, white pepper, gum-lac, ambergris, ſilk, and cotton, would long ſince have been objects of commerce which Madagaſcar would have yielded in profuſion, if the Europeans, in viſiting the iſland, had furniſhed the inhabitants with the neceſſary information for preparing and improving theſe ſeveral productions.

The ſugar-canes (as we are informed by another traveller||) are much larger and finer than any in the weſt Indies; being as thick as a man's wriſt, and ſo full of juice, that a foot of them will weigh two pounds. When the natives travel, they carry a ſugar-cane along with them, which will ſupport them for two or three days. Here are alſo plenty of tamarinds; and ſuch quantities of limes and oranges, that very large caſks may be filled with their juices at a trifling expence, as they may be purchaſed for iron-pots, muſkets, powder, ball, &c. During the ſhort time that Admiral Watſon's ſquadron ſtaid here in 1754, Mr Ives preſerved about half a hogſhead full of thoſe juices, which proved afterwards of the greateſt ſervice to the ſhips crews. It muſt be obſerved, however, that no good water is to be had at St Auguſtine in the ſouth-weſt part of the iſland, where ſhips uſually touch, unleſs boats are ſent for it four or five miles up the river; and inſtead of filling their caſks at low water (as is the caſe in moſt other rivers), they muſt begin to fill at

|| *Ives's Voyage to India, p.* 144.

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about a quarter's flood: The reaſon aſſigned for this is, that the river has a communication with the ſea at other places beſides this of St Auguſtine's bay; and it has been found by experience, that the ſea-water brought into the river by the flood-tide is not diſcharged till a quarter's flood of the next tide in St Auguſtine's bay; and for three miles up the river, the water is always very brackiſh, if not quite ſalt.

The abundance and variety of proviſions of every kind, which a fine climate and fertile ſoil can produce, are on no part of the globe, according to M. Rochon, ſuperior to thoſe of Madagaſcar: game, wild-fowl, poultry, fiſh, cattle, and fruits, are alike plentiful. The oxen, Mr Ives alſo informs us, are large and fat, and have each a protuberance of fat between the ſhoulders, weighing about 20 pounds. Their fleſh is greatly eſteemed by all the European nations trading to India, and ſhips are ſent to Madagaſcar on purpoſe to kill and ſalt them on the iſland. The protuberance of fat above mentioned is particularly eſtemed after it has lain ſome time in ſalt; but our author ſays, that he could not join in the encomiums either on this piece or the beef in general; as the herbage on which the creatures feed gives their fleſh a particular taſte, which to him was diſagreeable. The ſheep differ little from the goats; being equally hairy, only that their heads are ſomewhat larger: their necks reſemble that of a calf, and their tails weigh at leaſt ten pounds. Vaſt quantities of locuſts riſe here from the low lands in thick clouds, extending ſometimes to an incredible length and breadth. The natives eat theſe inſects, and even prefer them to their fineſt fiſh. Their method of dreſſing them is to ſtrip off their legs and wings, and fry them in oil.

The inhabitants (termed *Melagaches* or *Madecaſſes*), M. Rochon informs us, are in perſon above the middle ſize of Europeans. The colour of the ſkin is different in different tribes: among ſome it is of a deep black, among others tawney; ſome of the natives are of a copper colour, but the complexion of by far the greateſt number is olive. All thoſe who are black have woolly hair like the negroes of the coaſt of Africa: thoſe, on the other hand, who reſemble Indians and Mulattoes, have hair equally ſtraight with that of the Europeans; the noſe is not broad and flat; the forehead is large and open; in ſhort, all the features are regular and agreeable. Their phyſiognomy diſplays the appearance of frankneſs and of ſatisfaction: they are deſirous only of learning ſuch things as may adminiſter to their neceſſities; that ſpecies of knowledge which demands reflection is indifferent to them; ſober, agile, active, they ſpend the greateſt part of their time either in ſleep or in amuſement. In fine, according to the Abbé, the natives of Madagaſcar, like ſavages in general, poſſeſſes a character equally devoid of vice and of virtue; the gratifications of the preſent moment ſolely occupy his reflections; he poſſeſſes no kind of foreſight whatever; and he cannot conceive the idea that there are men in the world who trouble themſelves about the evils of futurity.

The population of the iſland has been eſtimated at four millions; but this calculation is thought exaggerated by our author, and indeed it appears incredible to us. Every tribe or ſociety inhabits its own canton, and is governed by its own cuſtoms. Each of theſe acknowledges a chief; this chief is ſometimes elective, but more uſually hereditary. The lands are not divided and portioned out, but belong to thoſe who are at the trouble of cultivating them. Theſe iſlanders make uſe of neither locks nor keys; the principal part of their food conſiſts in rice, fiſh, and fleſh; their rice is moiſtened with a ſoup which is ſeaſoned with pimento, ginger, ſaffron, and aromatic herbs. They diſplay wonderful cunning in catching a variety of birds, many of which are unknown in Europe: they have the pheaſant, the partridge, the quail, the pintado, the wild duck, teal of five or ſix different kinds, the blue hen, the black paroquet, and the turtle-dove, in great plenty; and alſo a bat of a monſtrous ſize, which is much prized on account of its exquiſite flavour. Theſe laſt are ſo hideous in their appearance, that they at firſt terrify the European ſailors; but after they have vanquiſhed their repugnance to them, they prize their fleſh infinitely before that of the pullets of their own country. The Melagaches alſo catch an immenſe quantity of ſea-fiſh; ſuch as the dorado, the ſole, the herring, the mackarel, the turtle, &c. with oyſters, crabs, &c. The rivers afford excellent eels, and mullets of an exquiſite flavour.

The inhabitants near St Auguſtine's bay, Mr Ives informs us, ſpeak as much broken Engliſh as enables them to exchange their proviſions for Europeon articles. Theſe, on the part of the Melagaches, are cattle, poultry, milk, fruit, rice, ſalt, porcelain, potatoes, yams, fiſh, lances, and ſhells. From the Europeans they receive muſkets, powder, bullets, flints, *clouties*, (including handkerchiefs, and linen of all kinds), beads, iron pots, &c.—Silver, which they call *Manila*, is in great eſteem with them, and is made by them into bracelets for their wives.

That part of the iſland at which the Engliſh ſquadron touched, is the dominions of the king of *Baba*, who, by the account of Mr Ives, ſeemed greatly to affect to be an Engliſhman. They had no ſooner touched at the iſland, than they were waited on by one called *Robin Hood*, and another perſon, both of whom bore the office of *purſers*. Along with theſe were *Philibey* the general; John Anderſon and Frederic Martin, captains. Nor did the king himſelf and his family diſdain to pay them a viſit; who, in like manner, were diſtinguiſhed by Engliſh names; the king's eldeſt ſon being called the prince of Wales, and the court not being without a duke of Cumberland, a prince Auguſtus, princeſſes, &c. as in England. All theſe grandees came on board naked, excepting only a ſlight covering about their loins and on their ſhoulders, made of a kind of graſs growing on the iſland; which they had adorned with ſmall glaſs beads by way of border or fringe. Their hair reſembled that of the Indians in being long and black, rather than the woolly heads of the African negroes. "The wives of the Melagaches (according to our author) take great pains with their huſbands hair; ſometimes putting it in large and regular curls; at other times braiding it in great order, and making it ſhine with a particular oil which the iſland produces. The men always carry in their hands a wooden lance headed with iron, which is commonly made very neat; and they are ſuch excellent markſmen, that they will ſtrike with it a very

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ſmall object at 30 or 40 yards diſtance. They have alſo commonly a muſket, which they get from Europeans in exchange for cattle, and are always ſure to keep in excellent order. I am ſorry to ſay (continues Mr Ives) that the Engliſh are frequently guilty of great impoſitions in this kind of traffic, by diſpoſing of cheap and ill-tempered barrels among the poor inhabitants, who ſometimes loſe their lives by the burſting of theſe pieces. Such iniquitous practices as theſe muſt in the end prove injurious to the nation; and has indeed already made the name of more than one half of theſe traders truly infamous among the deluded but hitherto friendly Madagaſcarians.

"They are a civil and good-natured people, but eaſily provoked, and apt to ſhow their reſentment on the leaſt provocation, eſpecially when they think themſelves injured or ſlighted. Another characteriſtic of them is, the very high notions of dignity they entertain of their king; which is carried to ſuch a height, that they are never more ſenſibly hurt than when they imagine he is treated with incivility or diſreſpect. This mighty monarch reſides in a town built with mud, about 12 miles up the country from St Auguſtine's Bay. On the eaſt ſide of the bay, as you enter, there reſided one Prince William, a relation and tributary to the king; but who in moſt caſes acted as an independent prince, and always uſed his utmoſt endeavours with the officers to cauſe them buy their proviſions from him, and not from the king or his ſubjects. In this prince's territories, not far from the ſea, are the remains of a fort built by Avery the Pirate.

"All the women of Madagaſcar, excepting the very pooreſt ſort, wear a covering over their breaſts and ſhoulders, ornamented with glaſs beads, and none go without a cloth about their loins. They commonly walk with a long ſlender rod or ſtick. The men are allowed to marry as many women as they can ſupport.

"During our ſtay at this iſland (ſays Mr Ives), I obſerved, with great concern, ſeveral miſerable objects in the laſt ſtage of the venereal diſeaſe. They had not been able to find any cure; and as far as I could learn, their doctors are totally ignorant of medicine. The only method they uſe for curing all diſtempers, as well external as internal, is the wearing on the arm or neck a particular charm or amulet; or beſmearing the part affected with earth moiſtened with the juice of ſome plant or tree, and made up into a ſoft paſte.

"I took ſome pains to learn their religious tenets; and find that they worſhip one Univerſal Father; whom, when they ſpeak in Engliſh, they call *God*; and in whom they conceive all kinds of perfection to reſide. The ſun they look upon as a glorious body; and, I believe, as a ſpiritual being, but created and dependent. They frequently look up to it with wonder, if not with praiſe and adoration. They make their ſupplications to the *One* Almighty, and offer ſacifices to him in their diſtreſſes. I had the curioſity to attend a ſacrifice, at the hut of John Anderſon, whoſe father had for a long time been afflicted with ſickneſs. About ſun-ſet an ox was brought into the yard; and the ſon, who officiated as prieſt, ſlew it. An altar was reared nigh, and the poſt of it was ſprinkled with the blood of the victim. The head, after its being ſevered from the body, was placed, with the horns on, at the foot of the altar: the caul was burned on the fire, and moſt of the pluck and entrails boiled in a pot. The ſick man, who was brought to the door, and placed on the ground ſo as to face the ſacrifice, prayed often, and ſeemingly with great fervency. His eyes were fixed attentively towards the heavens, and his hands held up in a ſupplicating poſture. The ceremony ended with the ſon's cutting up the ox into ſmall pieces; the greateſt part of which he diſtributed among the poor ſlaves belonging to his father and himſelf; reſerving, however, ſome of the beſt pieces for his own uſe. Upon the whole, I ſaw ſo many circumſtances in this Madagaſcarian ſacrifice, ſo exactly reſembling thoſe deſcribed in the Old Teſtament as offered up by the Jews, that I could not turn my thoughts back to the original, without being ſenſibly ſtruck by the exactneſs of the copy."

When the ſquadron firſt arrived at Madagaſcar, the king of Baba, a man of about 60 years of age, was ill of the gout. Having demanded of admiral Watſon ſome preſents, the latter complimented him, among other things, with ſome brandy. The monarch then aſked him if he had any doctor with him, and if he was a great doctor, and a king's doctor? To all which being anſwered in the affirmative, he deſired him to bring ſome *mahomets* (medicines) for his ſick knee. With this requiſition Mr Ives deſigned to comply; but having waited until ſome officers ſhould be ready to accompany him, his majeſty, in the mean time, took ſuch a doſe of brandy as quickly ſent the gout into his head, and occaſioned his death. Mr Ives obſerves, that it happened very luckily for him that the monarch's deceaſe happened without his having taken any of the medicines intended for him, as it would have been impoſſible to avoid the imputation of having poiſoned him, which would certainly have been reſented by his loyal ſubjects.

The king's death occaſioned great confuſion; the grandees being deſirous that it ſhould be concealed for ſome time. This, however, was found impoſſible; on which they ſet off for the *Mud Town* about 11 o'clock the ſame evening. All the inhabitants of the village followed their example; leaving only the dogs, who ſet up the moſt hideous howling. Captain Frederic Martin coming to take leave of the Engliſh, begged with great earneſtneſs for a freſh ſupply of gun-powder; whiſpering that the king was dead, and that they ſhould in all probability go to war about making another. They had been formerly told, that one who had the title of *duke* of Baba would certainly ſucceed to the throne; but they afterwards learned, that Philibey the general having eſpouſed the cauſe of *Raphani* the late king's ſon, and taken him under his tutelage and protection, this youth, who was only about 16 years of age, ſucceeded his father as king of Baba.

The following is a deſcription of the ſouthern diviſion of the iſland, from the Abbé Rochon.

"That part of Madagaſcar in which fort Dauphin is ſituated is very populous. Almoſt all the villages are placed on eminences, and ſurrounded with two rows of ſtrong palliſadoes, ſomewhat in the manner of ſuch of our fences as are compoſed of hurdles and turf. Within, is a parapet of ſolid earth about four feet in height;

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"The people of the province of *Anoſſi*, near fort Dauphin, are lively, gay, ſenſible, and grateful; they are paſſionately fond of women; are never melancholy in their company; and their principal occupation is to pleaſe the ſex: indeed, whenever they meet their wives, they begin to ſing and dance. The women, from being happy, are always in good humour. Their lively and cheerful character is extremely pleaſing to the Europeans. I have often been preſent at their aſſemblies, where affairs of importance have been agitated; I have obſerved their dances, their ſports, and their amuſements, and I have found them free from thoſe exceſſes which are but too common among poliſhed nations. Indeed I was too young at this time for my obſervations to be of much weight: but if my experience be inſufficient to inſpire confidence, I beg the reader will rather conſider the nature of things, than the relations given by men without principles or intelligence, who fancy that they have a right to tyrannize over the inhabitants of every country which they can ſubdue. If the people of Madagaſcar have ſometimes availed themſelves of treachery, they have been forced to it by the tyranny of the Europeans. The weak have no other arms againſt the ſtrong. Could they defend themſelves by any other means from our artillery and bayonets? They are uninformed and helpleſs; and we avail ourſelves of their weakneſs, in order to make them ſubmit to our covetouſneſs and caprice. They receive the moſt cruel and oppreſſive treatment, in return for the hoſpitality which they generouſly beſtow on us; and we call them traitors and cowards, when we force them to break the yoke with which we have been pleaſed to load them."

In the ſecond volume of Count Benyowſky's Memoirs and Travels we have the following account of the religion, government, &c. of the people of this iſland. Madagaſcar.

"The Madagaſcar nation believe in a Supreme Being, whom they call *Zanhare*, which denotes creator of all things. They honour and revere this Being; but have dedicated no temple to him, and much leſs have they ſubſtituted idols. They make ſacrifices, by killing oxen and ſheep, and they addreſs all theſe libations to God. It has been aſſerted, that this nation likewiſe makes offerings to the devil: but in this there is a deception; for the piece of the ſacrificed beaſt which is uſually thrown into the fire is not intended in honour of the devil, as is uſually pretended. This cuſtom is very ancient, and no one can tell the true reaſon of it. With regard to the immortality of the ſoul, the Madagaſcar people are perſuaded, that, after their death, their ſpirit will return again to the region in which the Zanhare dwells; but they by no means admit that the ſpirit of man, after his death, can ſuffer any evil. As to the diſtinction of evil or good, they are perſuaded that the good and upright man ſhall be recompenſed, in this life, by a good ſtate of health, the conſtancy of his friends, the increaſe of his fortunes, the obedience of his children, and the happineſs of beholding the proſperity of his family: and they believe that the wicked man's fate ſhall be the contrary to this. The Madagaſcar people, upon this conviction, when they make oaths, add benedictions in favour of thoſe who keep them, and curſes againſt thoſe who break them. In this manner it is that they appeal to the judgment of Zanhare, in making agreements; and it has never been known, or heard of, that a native of Madagaſcar has broken his oath, provided it was made in the uſual manner, which they ſay was preſcribed by their forefathers.

"As to their kings and form of government, &c. The Madagaſcar people have always acknowledged the line of Ramini, as that to which the rights of Ampanſacabe or ſovereign belongs. They have conſidered this line as extinct ſince the death of Dian Ramini Larizon, which happened 66 years ago, and whoſe body was buried upon a mountain, out of which the river Manangourou ſprings; but having acknowledged the heir of this line on the female ſide, they re-eſtabliſhed this title in the year 1776. The right of the Ampanſacabe conſiſts in nominating the Rohandrians to aſſiſt in the cabars, at which all thoſe who are cited are bound to appear, and the judgment of the Ampanſacabe in his cabar is deciſive. Another prerogative of the Ampanſacabe is, that each Rohandrian is obliged to leave him by will a certain proportion of his property, which the ſucceſſors uſually purchaſe by a ſlight tribute or fine. Thirdly, the Ampanſacabe has a right to exact from each Rohandrian one tenth of the produce of his land, and a number of horned cattle and ſlaves, in proportion to the riches of the country poſſeſſed by each Rohandrian.—The ſecond order is compoſed of the Rohandrians, or princes. Since the loſs of the Ampanſacabe, three of theſe Rohandrians have aſſumed the title of *kings*, namely the Rohandrian of the province of Mahavelou, named *Hiavi*; of the province of Voemar, named *Lambouin*; and a third at Bombetoki, named *Cimanounpou*. The third order conſiſts of the Voadziri, or lords of a diſtrict, compoſed

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compoſed of ſeveral villages. The fourth order conſiſts of the Lohavohits, or chiefs of villages. The fifth order, Odzatzi, who are freemen, and compoſe the attendants or followers of the Rohandrians, Voadziri, or Lohavohits. The ſixth order conſiſts of Ombiaſſes, or learned men; and this order forms the warriors, workmen, phyſicians, and diviners: theſe laſt poſſeſs no charge. The ſeventh order conſiſts of Ampurias or ſlaves.

"Having made inquiries from Bombetoki paſſing to the northward, and as far as Itapere, the reſult proved that there are 38 Rohandrians actually reigning, and 287 Voadziri. With reſpect to the Lohavohits, Ondzatzi, and Ombiaſſes, it was not poſſible to obtain any accurate determination of their number. Theſe orders preſerve a regular gradation, reſpecting which it would be very difficult to give a detailed account. They live in the manner we read of concerning the ancient patriarchs. Every father of a family is prieſt and judge in his own houſe, though he depends upon the Lohavohits, who ſuperintends his conduct. This laſt is anſwerable to his Voadziri, and the Voadziri to the Rohandrian.

"The Madagaſcar people having no communication with the main land of Æthiopia, have not altered their primitive laws; and the language throughout the whole extent of the iſland is the ſame. It would be a raſh attempt to determine the origin of this nation; it is certain that it conſiſts of three diſtinct races, who have for ages paſt formed intermixtures which vary to infinity. The firſt race is that of Zafe Ibrahim, or deſcendants of Abraham; but they have no veſtige of Judaiſm, except circumciſion, and ſome names, ſuch as Iſaac, Reuben, Jacob, &c. This race is of a brown colour.—The ſecond race is that of Zaferamini: with reſpect to this, ſome books which are ſtill extant among the Ombiaſſes, affirm, that it is not more than ſix centuries ſince their arrival at Madagaſcar.—With reſpect to the third race of Zafe Canambou, it is of Arabian extraction, and arrived much more lately than the others from the coaſts of Æthiopia: hence it poſſeſſes neither power nor credit, and fills only the charges of writers, hiſtorians, poets, &c.

"In regard to arts and trades, the Madagaſcar nation are contented with ſuch as are neceſſary to make their moveables, tools, utenſils, and arms for defence; to conſtruct their dwellings, and the boats which are neceſſary for their navigation; and laſtly, to fabricate cloths and ſtuffs for their cloathing. They are deſirous only of poſſeſſing the neceſſary ſupplies of immediate utility and convenience. The principal and moſt reſpected buſineſs, is the manufacture of iron and ſteel. The artiſts in this way call themſelves *ampaneſa vihe*. They are very expert in fuſing the ore, and forging utenſils, ſuch as hatchets, hammers, anvils, knives, ſpades, ſagayes, razors, pincers, or tweezers for pulling out the hair, &c. The ſecond claſs conſiſts of the goldſmiths (*ompaneſa vola mena*): they caſt gold in ingots, and make up bracelets, buckles, ear-rings, drops, rings, &c. The third are called *ompavillanga*, and are potters. The fourth are the *ompanevatta*, or turners in wood, who make boxes called *vatta*, plates, wooden and horn ſpoons, bive-hives, coffins, &c. The fifth, *ompan cacaſou*, or carpenters. They are very expert in this buſineſs, and make uſe of the rule, the plane, the compaſſes, &c. The ſixth are the *ompaniavi*, or rope-makers. They make their ropes of different kinds of bark of trees, and likewiſe of hemp. The ſeventh, *ampan lamba*, or weavers. This buſineſs is performed by women only, and it would be reckoned diſgraceful in a man to exerciſe it. The *ombiaſſes* are the literary men and phyſicians, who give advice only. The *herauvitz* are comedians and dancers.

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"The Madagaſcar people always live in ſociety; that is to ſay, in towns and villages. The towns are ſurrounded by a ditch and palliſades (as already mentioned), at the extremities of which a guard from 12 to 20 armed men is kept. The houſes of private people conſiſt of a convenient cottage, ſurrounded by ſeveral ſmall ones: the maſter of the houſe dwells in the largeſt, and his women or ſlaves lodge in the ſmaller. Theſe houſes are built of wood, covered with leaves of the palm-tree or ſtraw.

"The houſes of the great men of the country are very ſpacious; each houſe is compoſed of two walls and four apartments: round about the principal houſe other ſmaller habitations are built for the accommodation of the women, and the whole family of the chief; but the ſlaves cannot paſs the night within them. Moſt of the houſes inhabited by the Rohandrians are built with taſte and admirable ſymmetry."

The French attempted to conquer and take poſſeſſion of the whole iſland, by order, and for the uſe of, their Moſt Chriſtian Majeſties, Louis XIII. and XIV. and they maintained a footing on it from the year 1642 to 1657. During this period, by the moſt cruel treachery, they taught the native princes the barbarous traffic in ſlaves, by villanouſly ſelling to the Dutch governor of Mauritius a number of innocent people, who had been aſſiſting them in forming a ſettlement at Fort Dauphin.

The Abbé Rochon tells us, that the inſalubrity of the air in Madagaſcar determined his countrymen in 1664 to quit that immenſe iſland, in order to eſtabliſh themſelves at ſo inconſiderable a place as the Iſle of Bourbon, which is ſcarcely perceptible in a map of the globe: but it is apparent, from the account of the ſtate of the French affairs on the iſland of Madagaſcar in 1661, when Flacourt's narrative was publiſhed, that their ill treatment of the natives had raiſed ſuch a general and formidable oppoſition to their reſidence in the country, that the French were obliged to abandon their poſſeſſions for other reaſons than the unhealthy qualities of the climate. We have not room here for a detail of all the oppreſſive meaſures of the French, which the Abbé himſelf candidly cenſures in the ſtrongeſt terms; but ſhall extract the following narrative, both becauſe it is intereſting in itſelf, and exhibits the cauſes and the means of their expulſion.

La Caſe, one of the French officers employed by the governor of Fort Dauphin againſt the natives, was ſo ſucceſsful in all his enterpriſes, that they called him *Deaan Pous*, the name of a chief who had formerly conquered the whole iſland. The French governor, jealous of his renown, treated him harſhly, and refuſed to allow him the rank or honours due to his valour. The ſovereign of the province of Amboulle, called *Deaan Raſcitat*, taking advantage of his diſcontent, prevailed on him to become his general. Five Frenchmen followed him. Deaan Nong, the daugh-

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ter of Raſcitat, captivated by the perſon and heroiſm of La Caſe, offered him her hand with the conſent of her father. The chief, grown old, infirm, and arrived at the laſt ſtage of exiſtence, had the ſatisfaction of ſecuring the happineſs of his ſubjects, by appointing his ſon-in-law abſolute maſter of the rich province of Amboulle. La Caſe, in marrying Deaan Nong, refuſed to take the titles and honours attached to the ſovereign power: he would accept of no other character, than that of the firſt ſubject of his wife, who was declared ſovereign at the death of her father. Secure in the affection of this princeſs, who was not only poſſeſſed of perſonal charms, but of courage and great qualities, he was beloved and reſpected by her family, and by all the people of Amboulle, who reverenced him as a father; and yet, how much ſoever he wiſhed it, he was unable to contribute to the proſperity of his countrymen at Fort Dauphin, whom he knew to be in the utmoſt diſtreſs. The governor, regarding him as a traitor, had ſet a price on his head, and on the heads of the five Frenchmen who had followed him. The neighbouring chiefs, irritated at this treatment of a man whom they ſo much venerated, unanimouſly refuſed to ſupply the fort with proviſions. This occaſioned a famine in the place, which, with a contagious fever and other maladies, reduced the French garriſon to 80 men.

The eſtabliſhment at Fort Dauphin, on the point of being totally deſtroyed, was preſerved for a ſhort time from ruin by the arrival of a veſſel from France, commanded by Kercadio an officer of Brittany, who, with the aſſiſtance of a young advocate who had been kidnapped on board the veſſel, prevailed on the envious and implacable governor Chamargou, to make peace with La Caſe and his ſovereign ſpouſe Deaan Nong. This peace, however, laſted but for a ſhort time; the French, reſtleſs and inſolent to the neighbouring nations, again drew on them the vengeance of the natives. Even the few friends whom they had been able to acquire by means of La Caſe, were rendered hoſtile to them by the tyrannic zeal of the miſſionaries; who, not contented with being tolerated and allowed to make converts, inſiſted on Deaan Manang ſovereign of Mandrarey, a powerful, courageous, and intelligent chief, well-diſpoſed to the French, to divorce all his wives but one. This prince, not convinced of the neceſſity of ſuch a meaſure, aſſured them that he was unable to change his habits and way of living, which were thoſe of his forefathers. "You would allow me (ſays he) to have one wife; but if the poſſeſſion of one woman is a bleſſing, why ſhould a numerous ſeraglio be an evil, while peace and concord reign among thoſe of whom it is compoſed? Do you ſee among us any indications of jealouſy or hatred? No, all our women are good; all try to make me happy; and I am more their ſlave than their maſter." This ſpeech had no effect on father Stephen, ſuperior of the Madagaſcar miſſion. He peremptorily ordered him inſtantly to repudiate all his wives except one; and threatened, in preſence of the women, to have them taken from him by the French ſoldiers if he heſitated in complying with his commands. It is eaſy to imagine, ſays M. Rochon, with what indignation this language muſt have been heard in the *donac* or palace of this prince. The females aſſailed the miſſionary on all ſides; loaded him with execrations and blows; and, in their fury, would doubtleſs have afforded him no more quarter than the Thracian women did Orpheus, if Deaan Manang, notwithſtanding his own agitation, had not made uſe of all his authority to ſave him. Madagaſcar, Madder.

In order to free himſelf from the perſecution of this prieſt, he removed with his family 70 or 80 miles up into the country; but he was ſoon followed by Father Stephen and another miſſionary, with their attendants. The chief, Manang, ſtill received them civilly; but he intreated them no longer to inſiſt on the converſion of him and his people, as it was impoſſible to oblige them to quit the cuſtoms and manners of their anceſtors. The only reply which Father Stephen made to this intreaty, was by tearing off the *oli*, and the amulets and charms which the chief wore as ſacred badges of his own religion; and, throwing them into the fire, he declared war againſt him and his nation. This violence inſtantly coſt him and his followers their lives: they were all maſſacred by order of Manang, who vowed the deſtruction of all the French in the iſland; in which intention he proceeded in a manner that has been related by an eye-witneſs, who was afterwards provincial commiſſary of artillery, in a narrative publiſhed at Lyons in 1722, intitled *Voyage de Madagaſcar*. "Our yoke (ſays the Abbé Rochon) was become odious and inſupportable. Hiſtorians, for the honour of civilized nations, ſhould bury in oblivion the afflicting narratives of the atrocities execriſed on theſe people, whom we are pleaſed to call barbarous, treacherous, and deceitful, becauſe they have revolted againſt European adventurers, whoſe leaſt crime is that of violating the ſacred rites of hoſpitality."

It was about the year 1672 that the French were totally driven from the iſland of Madagaſcar; and no conſiderable attempts were made to form freſh eſtabliſhments there till within theſe few years, by M. de Modave, and by Count Benyowſki; neither of which was attended with ſucceſs, for reaſons given by the Abbé, but which we have not room to detail.

MADDER. See RUBIA.

M. Macquer obſerves, that the Hollanders are obliged to the refugees from Flanders for the knowledge of manufacturing the root of madder; and that they generally cultivate it in freſh lands which have not been ploughed. The commodity, when manufactured, is diſtinguiſhed into different kinds, as grape madder, bunch-madder, &c. The grape-madder is the heart of the root; the other, beſides the heart, conſiſts alſo of the bark and ſmall fibres proceeding from the principal root. For that kind called *grape-madder*, the fineſt roots are picked out, the bark ſeparated at the mill, and the inſide root kept moiſt in caſks for three or four years, which makes it more fit for dyeing than otherwiſe it would be. Unleſs madder be kept cloſe in this manner, it is apt to ſpoil, and loſes its bright colour in a great meaſure. It is yellow at firſt, but grows red and darker with age. It ſhould be choſen of a fine ſaffron colour, in very hard lumps, and of a ſtrong though not diſagreeable ſmell.

The madder uſed for dyeing cottons in the Eaſt Indies, is in ſome reſpects different from that of Europe.

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